The American Journal of Surgery

EDITOR

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IN THIS ISSUE:

COMPLETE TABLE OF CONTENTS — PAGES I & III

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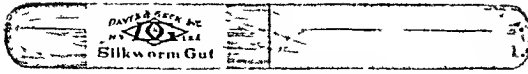
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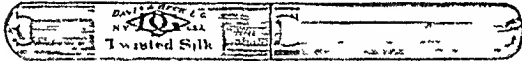
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The American Journal of Surgery

CONTENTS—JANUARY, 1928

ORIGINAL ARTICLES

·The American Journal of Surgery·

CONTENTS—JANUARY, 1928

Continued from page i

CASE REPORTS

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FIG. 1. Reproduction cast in wax of colon from Case 3940. Compare with roentgenogram of same colon (Fig. 2). Note: (1) Bilateral fixation of the transverse colon by the omentum. (2) Investiture of splenic flexure by the omentum. (3) Compression and anteroposterior angulation of ascending colon.

J. W. Draper and R. K. Johnson
    The Pathogenic Colon—Further Studies

THE PATHOGENIC COLON
RECENT STUDIES*

JOHN WILLIAM DRAPER, M.D., AND REDFORD KOHLSAAT JOHNSON, M.D.

NEW YORK

THE average human colon is clearly a compromise. It is a composite structure, part carnivore, part herbivore. Any student of the colon who is not mindful of its developmental vagaries as manifested in variations of form and function is ill-equipped to differentiate between the pathogenic and non-pathogenic colon.

The term, pathogenic colon, requires definition. It is a colon disorganized in such manner as to cause disease in other parts of the body. It is non-malignant, non-specific, never acute. Its pathogenesis is basically dependent upon chronic bacterial parasitism for which the fundamental predisposing cause is congenital dysmorphism, and the contributing cause gravitation.

Developmental anomalies have been noted by many writers. Few have done more than comment upon them as being interesting variations from an established order, without seriously questioning their derivation or possible pathogenesis. For the purposes of modern study no successful effort has been made looking to their correlation with established laws. They have long been regarded as isolated dissecting-room curiosities, no well-defined effort having been made to interpret them either at the operating table or at necropsy.

Thus to correlate and interpret them and to present further evidence pointing to the dominant part played by heredity in transmitting them is the principal purpose of this protocol.

EMBRYOLOGY

During the fifth and sixth weeks of embryonic life the dorsal wall of the then spindle-shaped stomach begins to distend, owing to rapid growth. The ventral wall, on the contrary, undergoes no change, with the result that the stomach now assumes a dorsal convexity which is later to become the greater curvature. Prior to the beginning of this development, usually at the end of the fourth week, the alimentary canal caudad to the stomach had consisted of a straight and undifferentiated tube. While these changes in the stomach are taking place this tube is also growing in length and is becoming folded. Aborad to the pylorus, which is still directed caudad, the tube turns dorsad for a short distance close to the vertebral column, where it again turns and proceeds caudoventrad to describe a large loop consisting of two nearly parallel arms. The caudoventral convexity of this loop is the site of attachment of the vitelline duct, which sometimes persists as Meckel's

diverticulum, and is the arbitrary mark between the primitive fore and hindguts. The dorsal arm of this loop, or hindgut, runs dorsocephalad, to bend caudad again near the vertebral column. The ventral arm, or foregut, together with a small portion of the dorsal arm, or hindgut, is to become the adult small intestine, but before this occurs it will undergo enormous increase in length. The remainder of the dorsal arm is to become the colon and together with the stomach and duodenum will undergo relatively little change. The fact that the beginning and the end of the alimentary canal arise from primitive structures which have their counterpart in practically all vertebrate embryos throws light upon the important physiological relationship between the adult structures referred to later.

During the fourth month the rotation of the stomach which had begun several weeks before is nearly completed. The cause of this rotation is not understood, but it serves to carry the terminal ileum and the rudimentary cecum near to the liver in what has been designated the "second position." Meanwhile, the transverse colon has elongated. Growth impulse is usually arrested as soon as rotation has taken place. This explains the occasional finding of the cecum and appendix in the upper right quadrant, and the difficulty in differentiating infantile appendicitis from pulmonary lesions. During this resting period it is not uncommon for membranes from the mesogastrium to become attached to the primitive cecum, the mesogastrium being in some cases extended to the right, to find insertion upon the liver, gall bladder and duodenum as well as upon the colon, cecum and terminal ileum. This accounts for the finding in adult life of the so-called hepato-duodeno-colic ligaments of various forms. When growth is resumed, a process sometimes delayed until extrauterine life, and the migration of the cecum caudad leads to the development of the so-called ascending colon, these mesogastric placements are dragged down as fan-like dis-

tributions of the omentum, often extending over the entire right portion of the large bowel. While it is relatively easy after a careful review of the embryological development so far outlined to explain the occurrence of certain right-sided pressure membranes, it has been much more difficult for the writers to understand their appearance upon the left side. The occurrence and frequency of their bilateral symmetry is also enigmatic. These questions have been considered in previous studies.[1,2,3]

CONSIDERATION OF AGE AND MORPHOLOGICAL VARIATIONS

The typical characteristic of the childhood colon is *uniformity* of appearance, just as other physical characteristics of children tend to uniformity. Moreover, the colon of the child is usually free from the minor variations found in later life, such as those resulting from ordinary or accidental wear and tear. Congenital variations, therefore, stand out sharply and unmistakably, it being usually unnecessary to differentiate them from acquired changes. The colon of the infant and child grows rapidly. Its physiological activities are accentuated. Its stability and final form are yet to be attained.

The typical characteristic of the adult colon is *diversity*. The fact that it must conform to the habitus entails upon it a wide range of morphological variation. The colon of the meso-ontomorph, often referred to as the hypersthenic, lies high in the abdomen under a wide costal arch. It is relatively short and the cecum is frequently found near the second position. The colon of the hyperontomorph, sometimes called hyposthenic, hangs low in the abdomen between a narrow costal arch and is relatively long in all of its components. Between these two types are found numerous gradations, any one of which may be considered as morphologically typical for a given individual, but when so considered it must also be proven to be functionally normal as related to that individual.

The typical characteristic of the colon of old age is also morphological diversity, plus a frequent almost habitual tendency to structural *degeneration*. Wear and tear has done its work. In old age the percentage of acquired abnormalities is relatively high and of congenital abnormalities relatively low. In childhood the reverse is true. The reason for this is not difficult to understand. Congenital colon dysmorphism shortens life.

Correlating our observations upon these typical colons of three salient age periods, the conclusions of Bryant[4] with regard to the normal incidence of visceral adhesions and bands are pertinent. He states:

1. The frequency of occurrence of adhesions or bands in the fetus of both sexes has been greatly underestimated. Of a group of 34 fetal cases of both sexes only 5.9 per cent were free from demonstrable adhesions or bands; 100 per cent of the 18 male feti showed such variations from the normal.

2. The adhesions present in the fetus are less varied in number and of a definitely less complex type than those found to occur in later life.

3. The age of forty is critical in both sexes. There is practically no increase in frequency above the fetal rate of involvement for the different viscera by adhesions until the age of forty. Beyond the age of forty there is a sudden increase of about 50 per cent in the involvement of the different viscera by adhesions in both sexes, the increase being somewhat more marked in the female than in the male.

PHYSIOLOGY

Water absorption in the stomach and small gut is negligible. The colon alone fulfills this function. Perhaps the earliest observation to this effect was made by the late Baron Munchausen. He is known to have remarked the astounding fact that his horse was able to drink water indefinitely after dashing under the falling portcullis. Immediately upon noting this physiological riddle he discovered that the answer was the accidental removal by the portcullis of the rear half of his horse, including of

course the colon. This is the first recorded instance of colectomy. In many other respects the analogy between the stomach and the colon, the beginning and the end of the alimentary canal, is striking. The common function of the two is storage plus churning. In the stomach this serves to blend water with the ingesta, in the colon to remove it. Neither the stomach nor the colon aids materially in digestion. The digestive function of the stomach can be dispensed with as readily as the water-absorbing function of the colon. These statements are at variance with generally accepted teaching, but they are easily verified in human beings or other vertebrates by the surgical removal of either organ.

The whole question of colon motility is still *sub judice*. We have observed hundreds of colons fluoroscopically without ever having seen mass motion in any but an irritable colon, and then but rarely. We do not deny that mass motion in a non-irritable colon may occur and probably does occur as a daily phenomenon associated with the normal defecatory impulse. Many observers have so reported. The theory of mass motion fails to explain to our satisfaction the equal distribution of barium found with such great frequency in functionally normal colons during routine serial examination. The frequent finding of a solid column of barium from the cecum to the splenic flexure twenty-four hours after the ingested meal does not in all respects support the theory of mass motion as the only prostaltic motor activity of the colon. Our observations of the apparent autonomic muscular activities of the excised colon confirm to some degree at least a theory of slow and imperceptible colonic movements based largely if not wholly upon segmental systoles and diastoles. The recently excised human colon, when thoroughly chilled and brought back to room temperature, has been observed to extrude its contents by an almost imperceptibly slow segmental contraction. Propulsion of the effluent is an important but

little understood function of the colon. It is the dominant function of the heart and the propulsive mechanism is there understood. The heart is a highly specialized systo-diastolic muscular pump, equipped with intricate valves. The colon is a poorly specialized systo-diastolic pump, equipped with primitive valvular folds and in some of the lower vertebrates, notably the dogfish, with the more special-

of intestinal motility. Mass motion in the colon, associated occasionally as it is with the stimulation of food passing into the stomach, is in large part if not wholly a reflex phenomenon. Motor transport through the colon impresses us as analogous to the horse-drawn transport of garbage through the main thoroughfare of a large city, the horse supplying the autonomic arrangement, the cart the physical

FIG. 2. CASE No. 3940. Typical bilateral omental deviation with involvement of splenic flexure. Constriction, rotation, pressure and degeneration. Profound neurasthenia and drug addiction. (See Figs. 1 and 3.)

FIG. 3. CASE No. 6051. Son of 3940 (Figs 1 and 2). Megacecum. Petit mal.

ized spiral valves. The heart musculature is autonomic and subject to reflex control. The same is true of the colon. In the heart, force, frequency and rhythm are dominant. In the colon these are underdeveloped and obscure. Motility of the effluent through the heart is rapid, through the colon very slow. Perhaps too much stress has been laid upon the reflex neuromuscular mechanism as being the sole initiator of motor function throughout the alimentary canal. The investigations of Alvarez[5] have thrown much light on the autonomic management

vehicle, and the driver, tripping the release of the dump cart at the journey's end, the neuromuscular reflex. Without the horse the driver's efforts would be fruitless if not disastrous.

SYMPTOMATIC ASPECTS OF THE PROTECTIVE MECHANISM

In the colon as in all other organs the occurrence of painful or disabling symptoms is almost always traceable to the protective reaction of the organism. Pain signifies spasm rather than dilatation. If pain is present with dilatation our clinical and roentgenological observations indicate

that spasm is also present though not always demonstrable. Sensory pain-endings are present in the parietal peritoneum but not in the visceral. Pressure sensory endings are probably present in the intestinal musculature just as they are in the voluntary musculature, and in both cases register pain as a result of spasm. But in the case of involuntary intestinal musculature, the pain which is misreferred or

origin, there remains a much more important and more frequently encountered type the origin of which can not be so easily explained. It is basically protective in character. It may be segmental or total in its distribution and in the main is the response to a physiological demand for rest. The mechanism of its production is neuromuscular. The paralytic ileus of acute peritonitis is protective. The atonia

Fig. 4. Case No. 6143. Obstructive right and left omental deviants. Colon damaged and pathogenic. Depression. Colectomy; recovered.

Fig. 5. Case No. 6273. Sister of 6143 and aunt of 6614. Megasigmoid with evidence of bilateral omental deviants. Early psychosis.

reflected to certain cutaneous areas obscures the proper evaluation of the deep-seated pain actually present in the viscera affected. The presence of this can hardly be questioned. Spasm and pain are physiological reactions to a pathological condition.

Alterations in motility, too frequently considered as pathological entities, are in reality physiological reactions to pathological states and are protective in their very nature. Diarrhea needs no comment. Protective constipation is less easily understood. Excluding the type of constipation which appears to have a purely mechanical

of chronic peritonitis is in the highest sense protective.

True mucous colitis has little pathogenic significance. The organized production of water-insoluble mucus by the colon is a highly protective response to certain types of infection and serves to inhibit pathogenesis even in the presence of severe and unalterable damage to the colon.

The neuromuscular relationship between the sphincters of the alimentary canal,

particularly the pyloric and ileocecal, is just as definite as it is delicate. Disturbance in intersphincteric balance is prone to follow pathological disturbances in the colon. Many stomachs are exhaustively and uselessly studied because of the frequently encountered syndrome of anorexia, nausea, vomiting, heartburn and gastric

how much greater must be the influence of that enigma, the colon, the intimate relationship of which to intra-abdominal disorders is just beginning to be understood. Many a diagnostic error has resulted from failure to recognize the fundamental integrity of the alimentary canal.
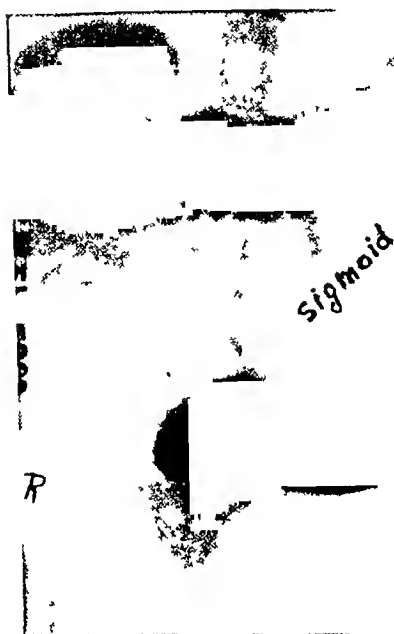
FIG. 6 CASE NO. 6614. Megasigmoid and probable right omental deviant in five-year-old niece of 6143 and 6273. Weight 35 lbs. Persistent constipation. Dwarfism. Note position of cecum.

FIG. 7. CASE NO. 5627. Long-standing colitis with fibrosis in female aged seventy. Not a pathogenic colon. Note right-sided dilatation and left-sided contracture.

retention. It is the hope of the clinician that he will be enabled to account for this train of symptoms by finding either a gastric or duodenal ulcer, cholecystitis or chronic appendicitis; in other words, something intrinsic in the stomach or in its immediate vicinity. Failing in this, is he justified in assuming that he is dealing with symptoms arising from a more or less vague and hopeless vagotonia or neurasthenia, or is it possible that he is confronted .with a physiological condition of somewhat remote origin, and one that is fundamentally protective? It is a far cry from the anal sphincter to the sphincter of the cardia, but cardiospasm and pylorospasm have been known to rest on so simple a foundation as anal fissure. If this be so,

PATHOLOGICAL ANATOMY

In discussing malformations in any part of the body it is necessary to know whether they are congenital in origin or whether they have been acquired after birth. In considering the human colon this distinction is difficult, particularly in the later years of life. In the first part of this paper we reviewed in some detail the occasional anomalous development of the omentum and referred to Bryant's classification and conclusions. We recited the mechanism by which the embryologically atypical omentum produces its deforming and damaging pressure upon the colon. There

is need for much further study of this subject. Hereditary transmission of gross anatomical defects in the colon, such as megacolon, megacecum and megasigmoid, is demonstrable by means of roentgen-ray studies of families. If, as we believe frequently happens, omental defects coexist with congenital colon anomalies, irregular and destructive pressure ensues and thus a fertile field is opened to any form of bacterial invasion. Such a colon may easily become a pathogenic colon.

The effect of gravitation upon the human abdomen has long been emphasized, but in the wrong direction. Since attaining to the upright posture mankind has developed a modus vivendi which, other things being equal, has enabled him not only to survive but to improve his species through the ages, gravitation notwithstanding. The handicap of gravitation and the upright posture has neither killed off the race nor arrested its development. It seems obvious that gravitation should exert its greatest pull on those organs which are relatively large and heavy, and that those individuals born with large colons should be more subject to a gravitational handicap than those born with small colons. This is true, and moreover, since the colon is the heaviest organ in the alimentary canal it is, more than any other part of the canal, subjected to the stress incident to the upright posture. The colon of the carnivore type, commonly seen in the slender or hyposthenic individual, is long in relation to the habitus, is cramped for space and finds it in the lower abdomen. This is not coloptosis, unless it be demonstrated that such a colon is abnormally mobile at the flexures as a result of changes in the application of gravitational force. We wish to emphasize that the whole theory of enteroptosis is mechanistic, that it frequently disregards function and that it usurps a position of importance far above its pathogenic merits. It is true that there is a higher incidence of colon disease in individuals of the hyposthenic type and it is probable that gravitation tips the scale

to the detriment of such an individual, but this may be true whether or not enteroptosis be present. Our position is at variance with the teaching of certain writers who have presented the hypothesis that bands, kinks and abdominal adhesions arise in the individual as a result of so-called lines of force, which are supposed often to be characteristic of specialized occupations. This explanation of these intra-abdominal variations is based upon the Lamarkian theory of adaptation or the acquisition of physical characteristics through the exercise of function. However true this may be philogenetically, it is inapplicable to the span of an individual life. The writers are convinced that the anomalies under discussion are almost invariably of chromosomic derivation.

Axial rotation of colon segments interferes with the normal geometric relationship of the circular and longitudinal muscle fibers. Disregarding all other considerations, such torsion of muscle bands and planes can and does produce profound functional disturbance, the severity of which we have had no means of measuring. True elbow deformities of the transverse colon, the majority of which are due to omental dysmorphism, usually combine in varying degree torsion and pressure, constricting or non-constricting, depending upon the character and the site of the insertion of the pressure membranes and the direction in which their force is applied. In any event, the end-result is a physical and neuromuscular disturbance of function. The degree of pressure or rotation produced by these omental and peritoneal variations in the first and second decades of life is relatively slight and often not incompatible with functional competence. During the second decade there begins contracture and devascularization of the fibrous connective tissue comprising these membranes. It is the result of a gradually developing and chronic peritonitis incident to the very pressure exerted upon the colon by the membranes themselves. Long-continued pressure, leading to progressive damage

to the colon wall so as to render it permeable, serves to augment the inflammatory reaction in the membranes, and a vicious circle is thus established. This accounts for the increasing incidence of colonic disease after the second decade.

(1) ulceration of the mucosa, usually microscopic and always minute; (2) atrophy of all the submucous structures with the sole exception of the serosa; (3) chronic inflammatory changes in the serosa. These lesions have a segmental distribu-
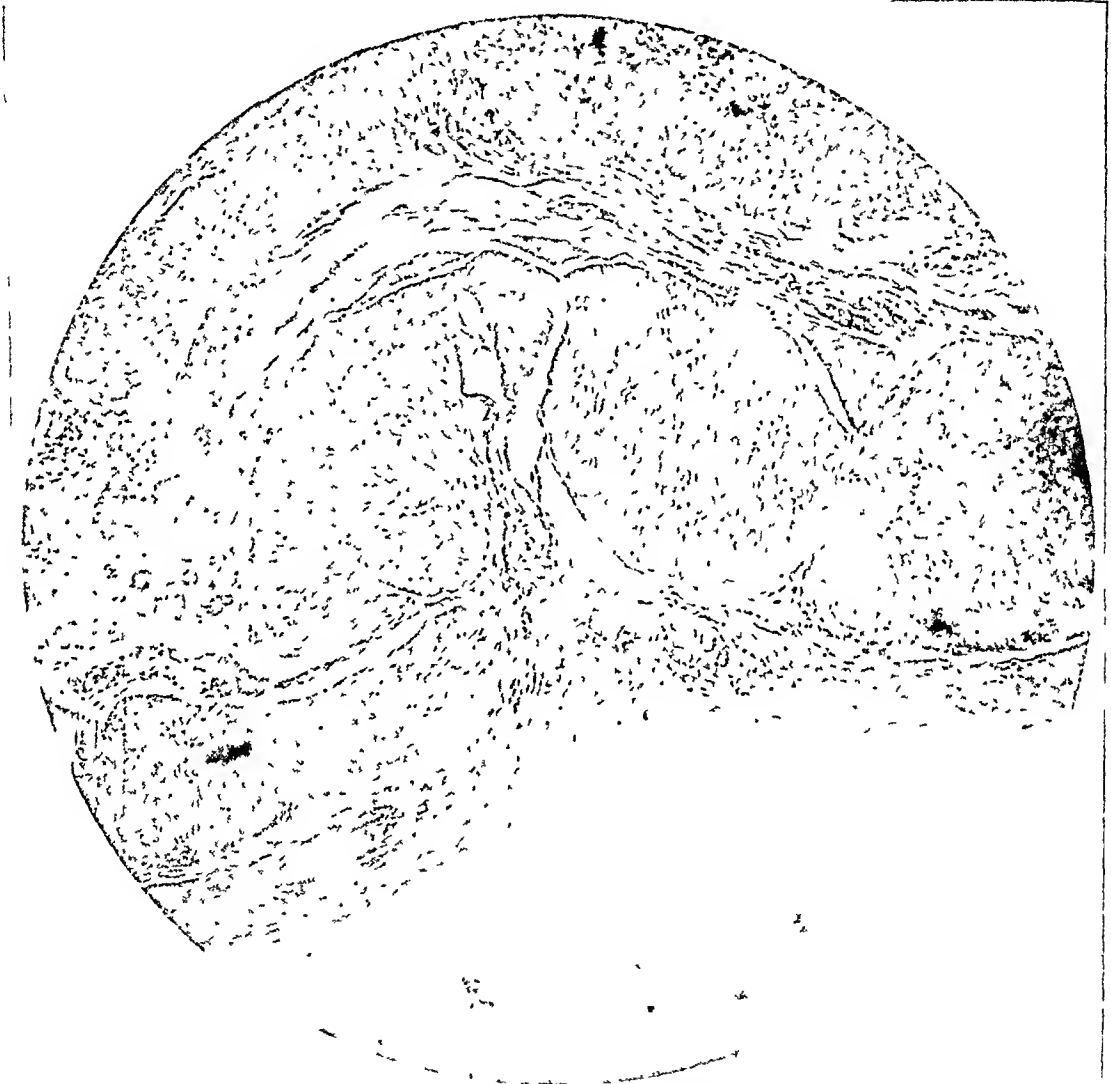
FIG. 8. Chronic peritonitis, with thickening of serosa of colon, in chronic obstipation. This process leads to the formation of bands, adhesions, and kinks. (Interpretation of Draper's material by Dr. James Ewing.)

We are unwilling at the present time to add further to the confusion of the nomenclature as applied to colon pathology. There are no terms briefly and adequately embracing the characteristic lesions under discussion. The typical gross and microscopic findings in the pathogenic colon are:

tion, as already intimated, and are prone to occur beneath the pressure bands. They are rarely found in the sigmoid or rectum and then only in late stages. In chronic ulcerative colitis, on the other hand, the typical lesion appears early and consistently in the sigmoid and rectum and the

FIG. 9. Chronic colitis. Stercoral ulceration. Hypertrophy of lymph follicle. Edema of submucosa. (Dr. James Ewing.)

changes in the submucous layers tend toward infiltration and hypertrophy rather than toward atrophy. In the pathogenic colon the entire structure of the bowel wall is involved and the term ulcerative colitis or any other accepted term fails to present the complete picture. The keynote of pressure colitis, as we designate it, is atrophy. The fibrosis following certain types of chronic colitis is protective and is seldom

a specific organism, and such search should prove fruitful. Many writers dealing with ulcerative colitis have neglected the importance of chronic oral and nasopharyngeal infection, but Bargen very rightly stresses both. His observations and those of his associate, Logan, as well as the laboratory studies of others, notably Torrey,[8] are the beginnings of what may well be a fundamental addition to our knowledge of this

FIG. 10. CASE No. 6437. Extremely long sigmoid, transmitted to daughter (Fig. 11). The colon is not degenerated and is not pathogenic.

FIG. 11. CASE No. 6547. Redundant colon in eight-year-old daughter of 6437. The sigmoid is large and filled with gas (see Fig. 10).

encountered in a colon which is truly pathogenic (Fig. 7).

BACTERIOLOGY

Of the colonic flora nothing of great clinical value is known. Bargen[6][7] has described a gram-positive lanceolate diplococcus which he considers to be the specific cause of certain forms of chronic ulcerative colitis. We cannot doubt that this lesion of the bowel wall is purely intrinsic and may well be due to specific bacterial invasion. Lacking evidence of extrinsic predisposing agents it is logical to seek for

disease. Torrey,[9] studying the flora of colon segments from material we furnished, has isolated B. histolyticus. This highly pathogenic anaerobe had been found but once in human feces, but Torrey's method of obtaining colon contents from tied-off segments immediately after total colectomy, as described in his recent article, is strongly suggestive that many important changes occur in the colon flora as the feces flow toward the rectum. In two

patients, one epileptic and one psychotic, upon whom total colectomy had been done by one of us, this investigator isolated B. histolyticus from the terminal ileum and cecum in each case, but failed to isolate it from the colon proper. He says: "In both, it [B. histolyticus] was present in the ileum to at least six inches above the ileocecal valve, and in one of the cases it was the predominant spore-bearing

FIG. 12. CASE No. 6552. Bilateral omental deviation with megasigmoid in five-year-old girl. Left flexure pulled down, right flexure looped. Mother is an intestinal invalid.

anaerobe in that locality. In the cecums also there was evidence of its predominance and active growth, whereas in both cases the colon seemed to offer unfavorable conditions for B. histolyticus and to permit the overgrowth of another representative of this group, B. welchii." The studies of McClintock[10] upon the occurrence of pleomorphism in an organism which produced

pathological lesions in the intestines of experimental animals, while they do not at present have the clinical application to which they may be entitled, none the less have served to indicate the enormous complexity of the whole problem of intestinal bacteriology.

CLINICAL FINDINGS

The symptoms are protean. They run
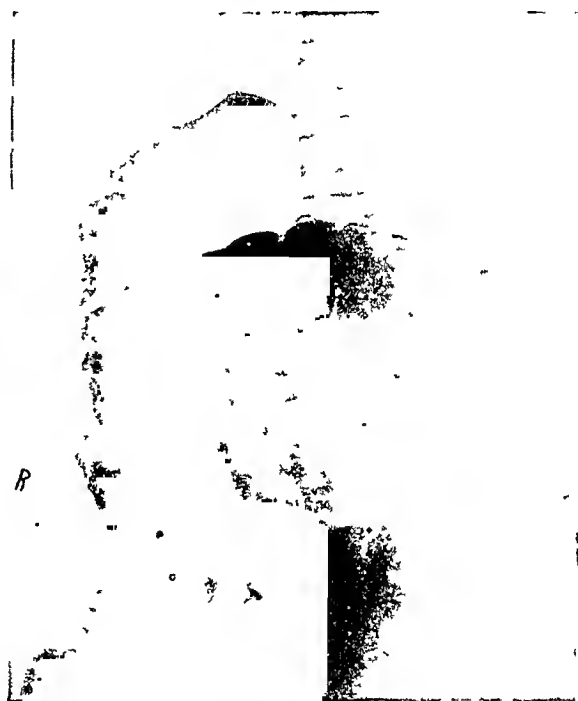
FIG. 13. Typical bilateral deviation of omentum, with constriction and pressure. Marked deformity of descending colon in pressure area. Neurasthenia.

the gamut of the body. They are as evanescent in character as the toxic products which cause them. They are as difficult to describe and as variable as are the symptoms of syphilis, and as in syphilis the final stages of the disease cover an enormous range of disability. The various morbid manifestations are as much dependent upon the reaction of the individual as they are upon the character of the toxins. In spite of this, and again much as in syphilis, there is a certain fundamental symptomatology. Every individual having a pathogenic colon will present in varying degree some or all of the following symptoms: (1) stomach trouble, ranging from

mild fickleness of appetite, abnormal desires or repulsions, abnormal hunger or anorexia, to varying degrees of indigestion, sometimes so severe and accompanied by so much pain as to simulate gastric or duodenal ulcer or even cancer; (2) irregularity

mental and physical. The variable symptoms which are not common to every patient are those which, taken in conjunction with the fundamental symptoms, point to colon pathogenesis. These fall into two sharply-defined groups, the physical and
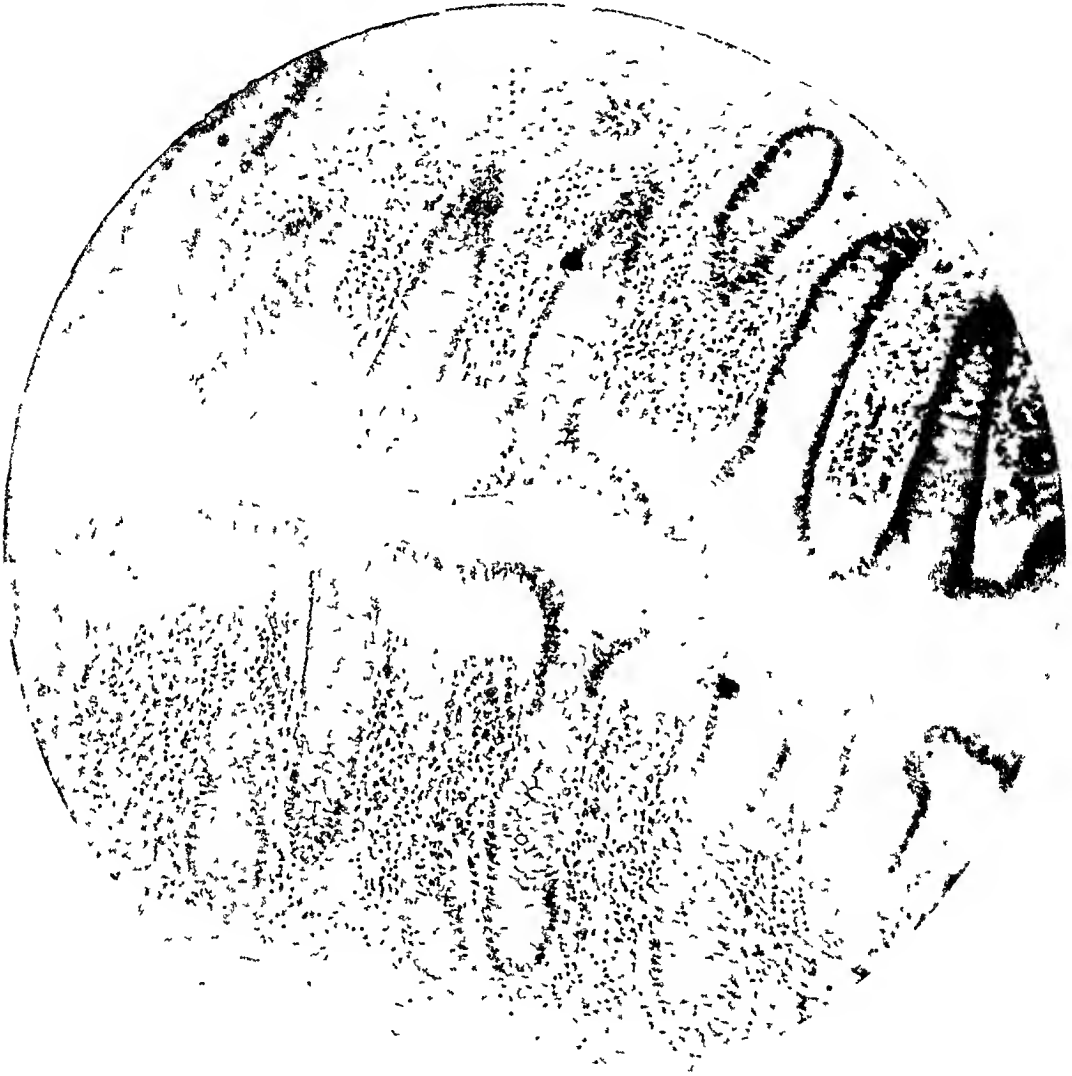
FIG. 14. Chronic colitis Subepithelial edema Heavy pigmentation of stroma cells in mucosa. (Dr. James Ewing.)

of bowel function, with chronic constipation predominating and occasionally alternating with periods of apparent freedom from constipation and even with diarrhea, which is often a form of paradoxical incontinence; (3) bilious attacks in childhood; (4) migrainal headaches beginning about the eighteenth year; (5) exhaustion,

the neuromental. In the first group the symptoms are those common to many joint diseases, notably arthritis deformans; to many obscure and chronic degenerative changes in the heart and kidneys; to certain so-called primary anemias[11]; to many, perhaps all, of the sensitized reactions of the skin and epithelial structures,

notably bronchial asthma, hives and eczema. In the second group the symptoms are those common to neurasthenia, to many degenerative changes in the cord and meninges, and to certain of the functional psychoses.

changes which follow in natural sequence, sometimes with such severity as to result in custodial care! No one can say that all neurasthenics suffer from colon disease, for the minority which is completely studied is very small and the majority
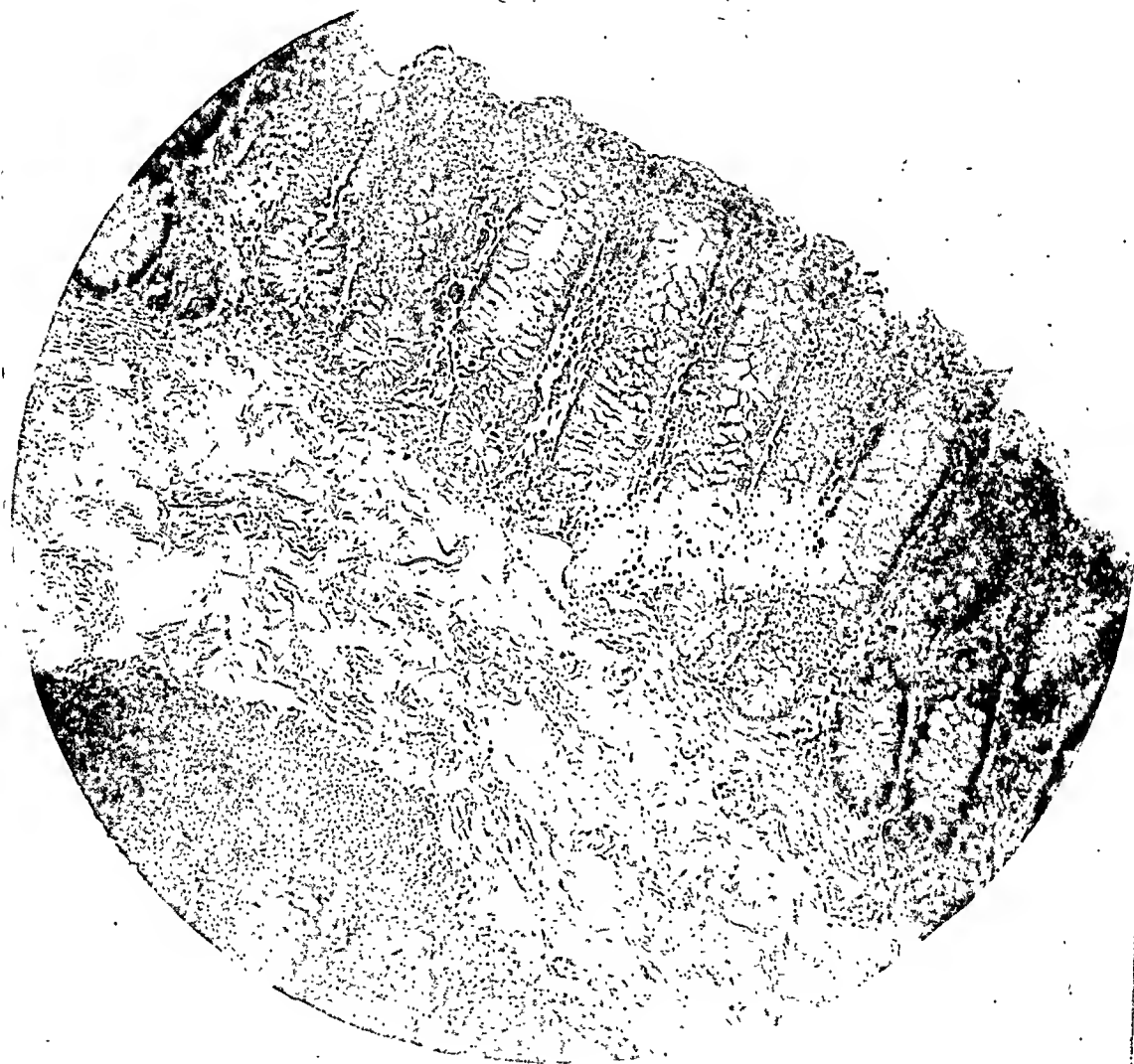
FIG. 15. Chronic colitis. Extreme pigmentation of mucosa. Erosion of superficial epithelium. (Dr. James Ewing.)

Consider the neurasthenic: who is not familiar with the vague but persistent neurosensory complaints of this unfortunate individual, suspended midway between health and disability, unable to work or to play, consistently shunted aside by family and by physician alike! Who has not witnessed the inevitable personality

that turns to metaphysics and mysticism is very large. In our experience no neurasthenic is free from evidence of gastrointestinal disorder. This usually involves the colon. Consider the psychasthenic: the term presupposes the separate existence of a soul, or psyche, which has become sick. For those to whom the dualistic theory of

the nature of man is of paramount interest the term is useful if not definitive. To us, as to others who are not dualists in thought or practice, the term adds nothing to the connotation conveyed in the somewhat less abstruse word neurasthenia. Consider the in neurasthenia and chronic intestinal invalidism. There is a history of "bilious attacks" in childhood interspersed with "dyspepsia" and "indigestion." The loss of the appendix in early life with disappointing and sometimes damaging
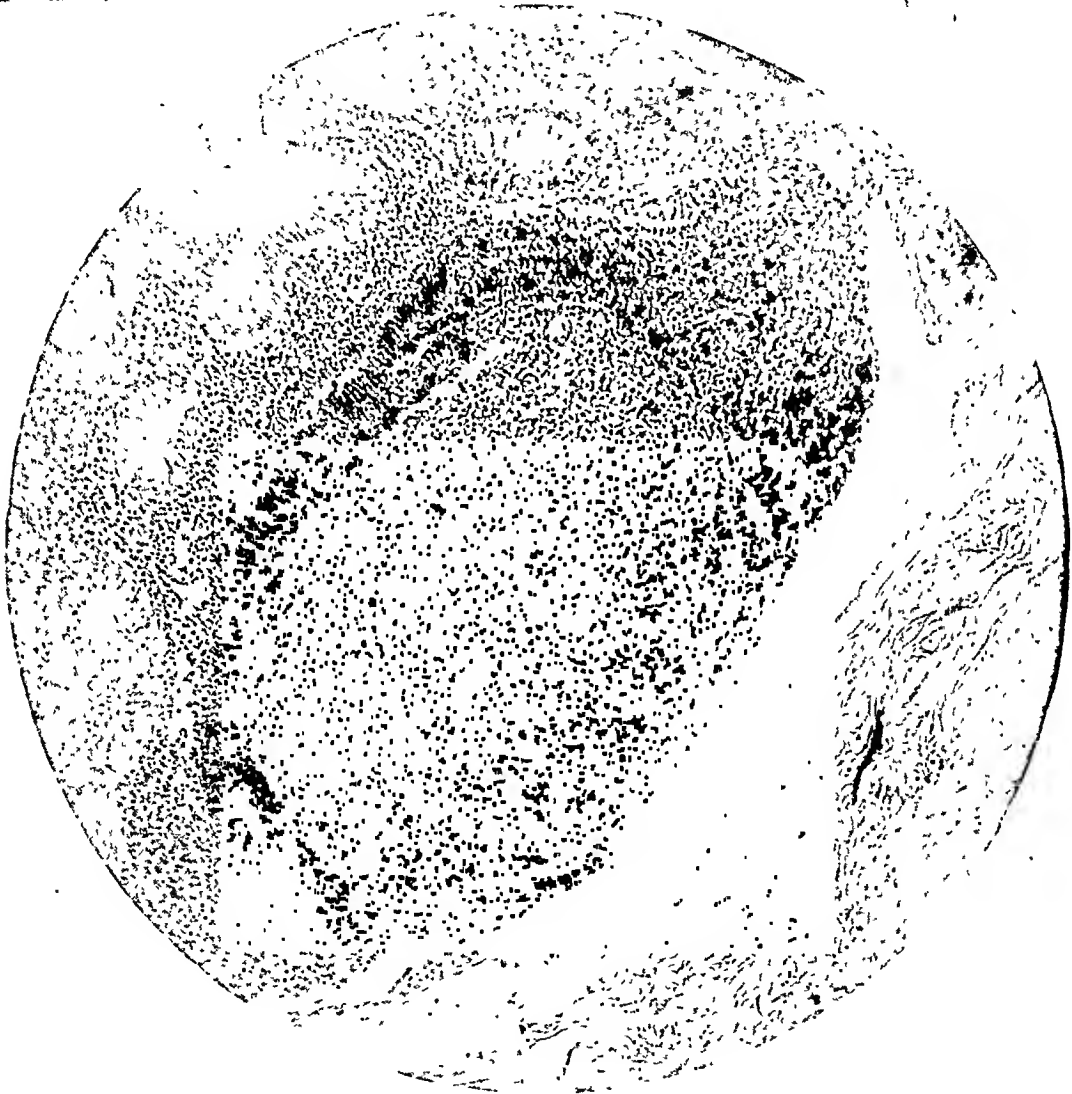
FIG. 16. Chronic colitis. Hypertrophy of mucous glands. Hypertrophy of lymph follicles. (Dr. James Ewing.)

early psychotic: here as in every early morbid manifestation the mental symptoms are vague, hidden, difficult of interpretation and frequently escape detection. The physical symptoms, on the other hand, are always definite, relatively easy to elicit and are usually of a kind with those found results is a frequent story. At about the sixteenth to the eighteenth year it is characteristic that the bilious attacks diminish or cease and that migrainal headaches appear. Constipation usually begins to be definitely noted at about this time, although a history, particularly from the

mother, will frequently elicit a definite story of constipation dating from infancy or early childhood. Infrequently this has alternated with diarrhea. Whatever the subjective symptoms may be, it is imperative for the physician to credit and evaluate the testimony of the patient, no matter how much at variance with probability it may appear and no matter how irresponsible the patient may seem. Many a patient can indicate with astonishing accuracy the position of a partial obstruction. We have found that an immense amount of invaluable diagnostic information can be elicited by careful questioning, even of a patient with the classical symptoms of dementia praecox.

DIAGNOSIS

Thus far the history has thrown the only light upon the patient's condition. The diagnosis of a pathogenic colon remains to be established. The physical examination ordinarily furnishes little information of real diagnostic value, for the patient is not necessarily undernourished, anemic or physically disabled. Low blood pressure and its attendant circulatory deficiency is often manifested in chilled, moist and sometimes blue extremities. Abdominal pressure-pain and rigidity may or may not be present. The laboratory findings vary with one exception. This is the frequently encountered inversion of the white blood cell ratio, a matter we discussed in another article.[12] When present this finding is presumptive evidence of a toxicosis, whether or not it originate in the colon. Stool examination with special reference to protozoa and bacteria is sometimes helpful. The urine frequently contains indican and occasionally melanin. It remains then for the roentgen findings alone to complete the chain of evidence without which the diagnosis of a pathogenic colon is not possible.

ROENTGENOLOGIC DIAGNOSIS

Thorough-going routine examination of the alimentary canal by the usual opaque serial meal should be completed in all cases. Usually it furnishes nothing more than a lead as to what may be expected with regard to the colon. The findings based upon the opaque meal alone are vague, incomplete and sometimes absolutely misleading. Therefore, examination of the colon by means of the opaque or semi-opaque suspension, injected rectally, should never be omitted. Frequently the opaque enema furnishes the only clue to the diagnosis, the serial examination having been entirely negative. On the other hand, reliance upon the opaque enema alone is dangerous, inasmuch as information thus obtained is incomplete, not only with regard to the colon itself but also to the remainder of the alimentary canal.

In considering the colon, the information gained by study of the serial meal relates largely to function. Alterations in motility may have real significance. Again they may have none. If the colon is empty at forty-eight hours it is wise to ask if a cathartic has been taken. This inquiry should be made of any habitual laxative user. On the other hand, if the colon remains filled at forty-eight or seventy-two hours, consider what has been the mode of life of the patient during the examination. Has he been inactive when usually active? Has he been subjected to excessive strain and worry with its attendant psychogenic effect upon peristalsis? While we hold that psychogenic influence upon the alimentary canal is transient, it is none the less potent. For if peristalsis in the cat ceases instanter upon sight of the detested dog, is it not probable that peristalsis in the human also may cease at sight of the doctor? Todd[13] has demonstrated this clearly in his work upon first and second year medical students. Moreover, the reliability of barium sulphate by mouth as a motility determinant is open to grave question. Its reaction is rather that of a foreign body which is capable of undergoing a great variety of physical changes in different hosts, than of the inert substance which it is

generally supposed to be. Its high specific gravity and its faculty for becoming glued together in hard masses by intestinal mucus are the principal objections to its use.

Barium detention in any part of the colon for a period of forty-eight hours or more requires explanation. It is not in itself ground for a diagnosis. Such detention in the cecum is common and is not necessarily pathologic. It may be physiologic, for the cecum, an independent storage viscus in certain closely allied mammals such as the horse, is preeminently the storehouse of the colon. Detention in the appendix is infrequent and when present may have no significance whatsoever. Moreover, an inflamed appendix is intolerant and will not store cecal contents unless forced to do so by reason of an obstructive lesion aborad to it. Retention in the entire colon leads to the assumption of rectal or rectosigmoid obstruction, spastic or otherwise. This assumption is frequently incorrect. It may be related to the presence of pressure membranes anywhere on the left side, as well as to chronic inflammatory changes in the female pelvis.

It occasionally happens that the serial meal indicates the presence of mucus in the colon, the so-called string shadows. It is by no means improbable that certain of these peculiar barium distributions appearing as stringy or ropy shadows are significant of much more than the mere presence of mucus-coated barium. The writers have observed at the operating table that in highly decompensated colons there may be found striking detention of fecal matter in all the haustral pockets of any given segment of the gut, and this in spite of thorough preoperative catharsis and irrigations. Upon opening such a colon this putty-like fecal material has been found adhering closely to the bowel wall. Ropy or stringy barium shadows may have been observed under such conditions. Sometimes valuable information with regard to the position and mobility of the colon is furnished. Sometimes diverticular pockets may be seen. Sometimes an annular obstruction is pointed out. Sometimes an angulation, an axial rotation, or a constriction due to pericolic membranitis is suggested. It will be noted that all this evidence is suggestive, often difficult to find and more difficult to interpret. We repeat, examination of the colon by the opaque enema must follow the serial meal, or the conclusions may be worthless.

The enema must be given under proper control, after adequate preparation and with standardized technique, must be roentgenoscopic as well as roentgenographic in its scope and should not conflict with the serial study. The manner in which the barium column advances should be carefully noted. There are points where it is normally delayed, namely the rectosigmoid juncture, the sigmoid-descending juncture and the two flexures. Other than momentary delay at any other point may be of pathological import. Unusual loops, angulations or constrictions which appear before the colon has become filled are frequently wiped out under the influence of increased intracolic tension and their significance, if any, is lost unless carefully recorded. If such deformities persist after controlled filling of the bowel, and this can usually be determined by digitation, there is little doubt that these are organic defects and not illusions resulting from redundancy or temporary spasm. By controlled filling we mean the method by which the filling of the bowel is checked roentgenoscopically at all stages of the procedure, first to insure adequate filling and second to avoid overdistension and the misinterpretation resulting therefrom. It is impossible that this can be accomplished by any form of volumetric calibration alone, because obviously each colon has its individual capacity and tone. The manner of filling together with the volume are the criteria upon which more nearly accurate conclusions as to colon capacity should be based. Moreover, the factors of hydrostatic pressure, temperature and viscosity should be constant for any given observer, so that

he may make at least reasonably accurate estimations of speed and filling capacity. The pressure used, when within reasonable limits, is immaterial so far as it affects determination of morphology, tonicity and capacity. The pressure together with the viscosity are the factors which determine the velocity of the fluid as it is delivered to the rectum and therefore these determine the speed with which the

Fig. 17. Case No. 4223. Megacolon, capacity 10 litres. (Wax reproduction.) Female aged thirty-five. Dementia praecox and multiple sclerosis. Duration of symptoms fifteen years. Colectomy. No improvement.

hollow viscus, tonic or obstructive considerations aside, will be filled. Were it not for these inconstant factors of muscle tone and unforeseeable obstructions, the capacity of the colon could be measured accurately by means of a stop watch and a mathematical formula. A determination of colon capacity, therefore, depends absolutely upon a proper appraisal of these two most important inconstant factors. Knowing from experience the speed with which the fluid is delivered to the rectum and knowing the average length of time which will pass before it reaches the cecum of an unobstructed orthotonic colon, estimation of the tone may be made as the colon is filling merely by observing the speed with which the barium advances. Rapid, almost instantaneous advance occurs between the normal delay points

in an hypertonic unobstructed bowel, with barium frequently reaching the cecum long before complete filling has occurred. A slow, irregularly advancing column with more or less complete filling of the bowel as the column progresses is characteristic of an hypotonic colon. Being familiar with the constants and bearing in mind tone characteristics, it is possible to formulate an opinion as to the quantitative value of

Fig. 18. Case No. 5661. Megacolon with constricting right omental deviant. Impossible to fill right side. Degenerative changes of entire bowel. Epilepsy, grand mal.

any obstruction encountered during the progress of the fluid merely by appraising the time factor of delay. It reveals little, however, as to the character of the obstruction. We wish to know whether the lesion is intramural and organic or spastic, or whether it is extramural and due to pressure from congenital or acquired abnormalities.

Gross angulations of the transverse colon are encountered with great frequency. Here the angulation is almost always directed caudad and is more frequently seen on the right side, where the

transverse colon is reflected or imbricated over the ascending in varying degree. Such a condition is by no means always inconsistent with adequate function. We use this phrase advisedly, never having been able to establish a true normal for the human colon. Left-sided imbrication is frequently nothing more than enforced angulation produced by disproportion between the width of the patient and the length of the transverse colon. If this be so, such an angulation is easily displaceable upon digitation and there will be found no evidence of constriction or extracolic pressure upon it or upon the descending bowel over which it lies. In any event it is important to learn, if possible, not only the amount of imbrication but the degree of fixation, constriction and pressure which accompany it. This can be accomplished only during screen examination.

There are further important observations which depend upon fluoroscopic study alone. The significance of spasm is always difficult to evaluate. All the elements entering into the occurrence of spasm must be considered. When, as well as where, does it occur? How long does it last? What is its relation to pain? Is it fleeting, constant, intermittent or recurrent, increasing or decreasing, always in the same place or cropping out in different segments? Finally, how is spasm manifested? Spasm appearing early and in the absence of considerable intracolic pressure is diagnostically significant, providing that the element of fear or other psychogenic considerations are absent and providing that the colon has not been too recently irritated by a cathartic or by other drugs. Spasm appearing late and in the presence of colon distention may mean merely an expulsive effort on the part of a healthy colon and in this event the spasm will be inconstant and temporary. If it is persistent, it should be considered as having possible pathological significance. Spasm occurs most frequently on the left side. This is usually a physiological reaction, since the left side is more concerned with motility than with storage and is therefore less tolerant of distention. This is true equally of the descending and pelvic colons. Spasm in the ascending colon and cecum, whether early or late, should be regarded critically and if any doubt remains the examination should be repeated. Spasm of the transverse colon likewise should be regarded with suspicion, always bearing in mind the possibility of a pressure defect from the spine. Spasm that is fleeting and migratory may be disregarded. Momentary recurrent spasm of the same segment may not be disregarded. Spasm that appears early, persists and is accompanied by pain should never be disregarded. The onset of spasm in any part of the colon is usually manifested by disappearance, more or less complete, of the opaque material from the segment involved. This may occur so suddenly as to escape the attention of the roentgenologist until it is completed, or so slowly that it likewise fails to attract attention. In barium mixtures which are not adequately suspended this segmental evacuation may be mistaken for sedimentation of the barium or vice versa. Pronounced exaggeration of haustral demarcation should not be mistaken for spasm, this being merely an exaggeration of normal characteristics rather than a true spastic state. Rarely, spasm is unaccompanied by segmental evacuation, and the changes produced by it are so slight that they can be seen upon the screen only with difficulty. Such spastic manifestations are probably the result of fibrillary contractions associated with disorganized haustration, and produce a fine feather-like outline in the contour of the bowel. This is very often significant of well-established ulcerative colitis in which the neuromuscular elements have been damaged sufficiently to produce incoordination, and is clinically comparable with the fibrillary contractions of heart muscle. Whether the term spasm is justified in its usage here is of small

importance. The word fibrillation as applied to colon musculature is not yet in general use, although it was introduced by Mills[14] three years ago.

Spasm of the sphincters, anal, recto-sigmoid and ileocecal, is usually impossible of detection excepting by inference. In this connection a word concerning the so-called incompetence or insufficience of the ileo-cecal sphincter is pertinent. Regurgitation

FIG. 19. CASE No. 6427. Megacolon in female aged twenty-two. Dementia praecox. Only the sigmoid is visualized. Complete filling would have been dangerous, the colon wall being like parchment (see Fig. 20).

of the barium suspension into the terminal ileum, after the cecum has become suffi-ciently distended, is to be expected and has no significance unless it occur very early. If a shadow appears in the terminal ileum as soon as the barium has reached the sphincter there is every reason to suppose that the muscle is incompetent, and in such a case enormous leakage into the small

intestine will continue so long as barium is allowed to flow into the rectum. On the other hand, if the terminal portion of the ileum fails to fill after complete distention of the ascending colon and cecum, and does not fill for some minutes there-after, a reasonable assumption of obstruc-tion, spastic or otherwise, is in order. The causes of such obstruction are not easy to differentiate. Spasm often predominates,

FIG. 20. CASE No. 6427. Photograph of formalin-fixed megacolon following colectomy. (See Fig. 19.) The bowel has been opened, note paper-like thinning of the wall. Dilatation is present but it is the *result* of atrophy, not the cause of it.

but there are unquestionably a great many instances where it plays little if any part. Adhesions involving the neck of the ileum in torsion or angulation are sometimes suggested when a small part only of the terminal ileum is visualized. Obstructive lesions of the ascending colon, many of them due to omental deviants, are prone to cause motor delay in the terminal ileum, and in such cases the ileocecal sphincter may be spastic, incompetent or may have remained functionally normal. In young subjects nodular hyperplasia of the mucous membrane of the terminal ileum may constitute an intrinsic source of partial obstruction. Fibrosis of the sphinc-teric muscles may result either in incom-petence or obstruction. In general, it will be found worth while to search patiently

for localized or remote lesions which may be responsible for functional irregularities of the ileocecal sphincter, for almost invariably such lesions can be found. Spastic manifestations of the anal sphincter do not fall directly within the scope of the roentgenologist except on rare occasions. Spasm of the rectosigmoid sphincter is not easily detected unless it be of sufficiently severe degree to cause a noticeable increase of the usual delay to the opaque fluid at this point, as well as a definite exaggeration of the divisional incisura between the rectum and sigmoid.

The human colon always presents certain well-defined characteristics of *size*, *contour* and *position*. The roentgen-ray film is of value principally with regard to the information it records concerning these three elements.

Correct evaluation of *size* variations is always difficult and especially so in children. In adults a rough estimation based upon the fluid capacity of the empty colon may be possible, but the accuracy of this estimation depends more upon considerations of habitus than of body weight. In children the determination of habitus is difficult, if not impossible, and can usually be arrived at only by inspection of the parents, comprising if possible roentgenological study of their colons. The diagnosis of true megacolon is not difficult. Hirschsprung's disease is nothing more than pronounced megacolon in infancy, in which the degenerative changes are sufficiently established to permit of pathogenesis. This shortens life. Megacolon is found in adults and is congenital, but it has escaped the label of Hirschsprung's disease because it did not degenerate in childhood. Megasigmoid and megacecum, so-called, and also cecum mobile, are found from childhood to old age, but the mortality rate is high, life expectancy depending upon the onset and progress of degenerative change. In addition, these congenital variations in size may be further modified later by the processes of dilatation, elongation and contracture discussed elsewhere.

Early *contour* changes are frequently missed at screen examination. We have spoken of the feathered contour as being rather definitely suggestive of the fibrillary spasm incident to an ulcerative colitis, but we cannot be too certain that it is not also produced by other less definitely understood forms of colon disease. The interpretation of every variety of contour change in the colon is difficult and depends upon a knowledge of the underlying mechanism by which colon contour is controlled and maintained. For the sake of brevity we may disregard the roentgenographic effect, if any, of colon mucosa upon colonic contour. Certain hypertrophic diseases of the mucosa do change the outline, but their incidence is rare and not within the scope of this paper. Diverticulosis is common, but is not confined to the mucosa.

It is obvious that the contour of a hollow viscus is dependent to a large extent upon its muscular form and function. The arrangement of the colon musculature is complex and the contour changes resulting from disturbance in muscular balance are likewise complex. The circular fibers of the inner layer comprise the larger part of the colon musculature. They are more or less uniformly distributed but tend to group themselves in bundles which are supposed to correspond to the normal intersacculations of the colon. It is improbable that these fibers exert more than secondary influence in producing sacculation. Increase in their activity leads to broad incisurae which sometimes simulate true haustra very closely. Overactivity of the circular fibers may accentuate haustration, but it more frequently interferes and leads to confusing contour changes. The longitudinal muscle layer is the external one and is spread thinly over the wall of the colon excepting at the three points in its circumference where the taeniae coli are laid down. It is the longitudinal fibers which are largely responsible for the colon sacculations, and disorganization of these fibers, hypertonic or hypotonic, results in an increase or a decrease in the quantity and quality of the

haustral markings. When the colon musculature is subjected to any abnormal stimulus certain contour changes become apparent, depending upon the character of the stimulus. An irritant attacking the circular fibers produces abnormal activity, this resulting in any degree of contraction from an incisura to total spasm of a segment. A degenerative irritant which destroys as it invades, when attacking the

contour in the form known as feathering or serration.[13] It is significant of the presence of an active and degenerating irritant. Thus the end-result of degenerative processes is inevitably either muscular atrophy and dilatation or muscular atrophy plus fibrosis leading to contracture. In each case, muscle atrophy finally leads to permanent change of contour.

As developed in the discussion of enter-
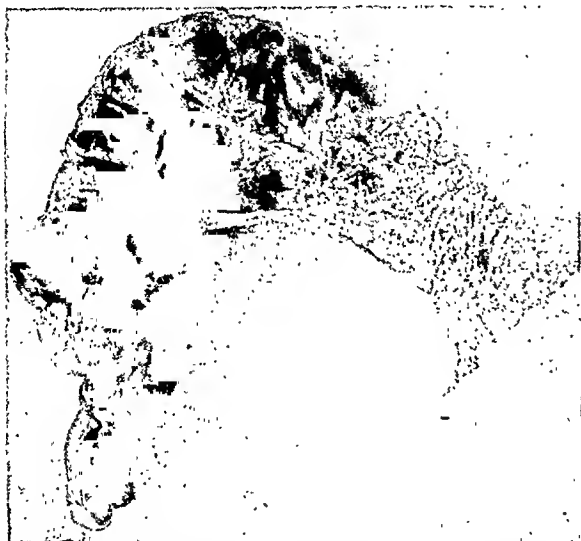
Fig. 21. Photograph of specimen showing remnant of right omental deviant, transverse to ascending.
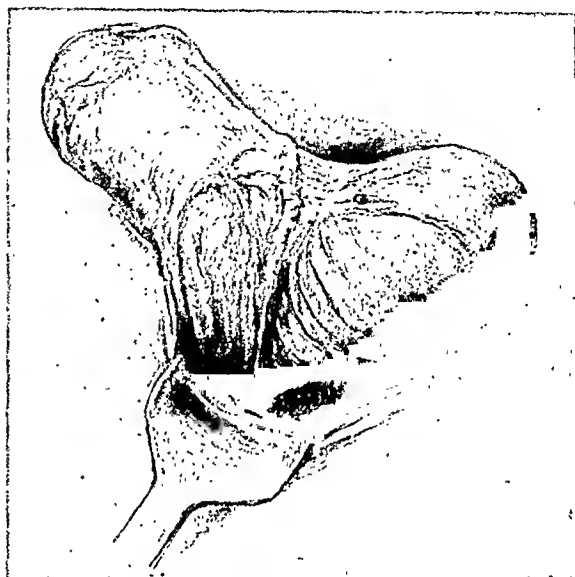
Fig. 22. Right omental deviant crossing ascending colon to become adherent to lower pole of right kidney, with extreme angulation of and pressure upon the bowel.

circular coat leads to varying degrees of dilatation without particularly disturbing haustration. Irritation of the longitudinal fibers may lead to exaggerated haustration complicated by the contour changes produced by circular disorganization. Degeneration of the longitudinal fibers, on the other hand, leads to relaxation and decrease or loss of haustration. Thus degeneration of circular fibers leads to dilatation, and degeneration of longitudinal fibers leads to elongation of the colon. The first results in obvious increase in diameter, the second in folds or reduplications compensating for the added length. Muscular irritation which is chronic, persistent and ever-present, but of comparatively recent origin, produces that kind of conjoined dystonia of both circular and longitudinal fibers which has been characterized as fibrillation and which affects the

optosis, consideration of the *position* of the colon as a whole or in its parts frequently leads nowhere, perhaps serving only to confuse rather than to enlighten. Definite displacement and unusual mobility of the flexures, when not due to dislocation or enlargement of the liver or spleen, are significant if one can be sure that abnormal mobility is present. This distinction is not easy, for the flexures are very difficult if not impossible to palpate and reliance must therefore be placed upon the effect of postural change. The splenic flexure and, to a lesser degree, the hepatic are subject to traction and distortion by longitudinal and encircling bands and may be displaced caudad or mesiad, or both, not because of relaxation of the mesentery primarily, but

because of contracture of congenital or acquired investiture. In every other respect so-called abnormal position of any part of the colon will be found to be a placement imposed upon it by intra-abdominal pressure. The finding of the cecum in the true pelvis, sometimes to the left of the midline, is characteristic of megacecum and cecum mobile rather than of ptosis, since the pendent mesentery is of developmental rather than acquired origin. It occasionally happens that in the case of a very long ascending colon the cecum will not be displaced from its usual position in the right iliac fossa. If this be so, it will tend to be fixed in position, capable of upward but of very little downward displacement, and the ascending colon will be found to be bent or folded upon itself in various ways. The cecal fixation then is from above and is very often the result of investiture from an embryologically aberrant omentum (Fig. 6). Which of these two forms of cecal dysmorphism carries the greater pathological import, the large ascending colon with a low mobile cecum or the large ascending colon with a high fixed cecum? It is the latter, for the cecum is not in its correct position as related to the ascending colon, and the folding of this portion of the bowel is functionally embarrassing. This takes no cognizance of the additional effect of omental pressure upon the ascending colon or of the direct transmission through the omentum of gravitational drag to the transverse colon, duodenum and stomach, now called upon to carry a heavy cecum which should derive its support from its own mesentery. With regard to the position of the appendix we may say briefly that it lies, and lies, and lies. Roentgenologic study of the appendix is usually about as reliable as the cackle of the Missouri hen, loudly proclaiming that she might have laid but has probably lied.

Summary. It is apparent that the roentgenologic diagnosis of colon disease is complicated. It is also an undeveloped field. First, there is no accepted normal, each individual being a law unto himself.

Second, the presence of demonstrable alteration in colon morphology must be interpreted in the light of all the elements entering into it. Colon irritability as shown by spasm or other functional disturbance may be the result of an emotional upset, of a drug or of an intrinsic colon lesion. Colon hypotonia may be due to unnecessary and too-prolonged clysmatic pressure, with resultant dilatation and decrease in haustration, or it may be due to a degenerative process. In the latter case there will almost always be found some embarrassing deformity of the bowel which is etiologically related to it. These deformities may be real or apparent. If real, there will be found greater or less fixation, pressure or constriction; if apparent, these are absent. Dysmorphism associated with abnormally large segments of colon is likely to be of congenital origin and when not so associated may still be congenital, although the roentgenologist is unable to say this unless he has similarly examined other members of the same family. This opens up a field of roentgenological endeavor which has heretofore been unexplored.

TREATMENT

The therapeusis of patients suffering from chronic colon pathogenesis must be based upon the most careful and conscientious analytical study, and above all, must be deliberate. This course is almost invariably contrary to the wishes of the patient who hopes and expects that treatment, to him all-important, shall be instituted at once. Beware of the confusion of contemporaneous diagnosis and therapeusis. Perhaps even more definitely than in disorders of other parts of the body, successful treatment of those of the alimentary canal depends upon knowledge of its intercorrelation and recognition of its integrity. Specifically we refer to the coexistence of a colitis of whatsoever type with chronically infected teeth, tonsils and sinuses. On account of the difficulty attendant upon its elucidation, the direct

path by which such infections serve to maintain degenerative involvement of the colon will probably long remain unknown. Empirically, however, it can easily be shown that extensive clinical improvement may be expected to occur in a diseased colon if the oral sepsis is removed before any therapeusis is applied directly to the colon. Parenthetically, this is true of the common pelvic infections, endocervicitis and vesiculitis. Here the relationship is one of contiguity rather than of continuity, but clinical results show that it is none the less important in instituting treatment.

After a proper interpretation of the roentgen-ray studies it is often possible to say at once that the therapeusis of a given case is surgical. We refer of course to instances of partial obstruction due to congenital or acquired abnormalities which have resulted in such positional changes as to cause severe colon disorder. These must first be relieved by proper surgical intervention and must then be treated medically for a long time. We cannot overemphasize that this is true of every case treated surgically. Nothing could be more disastrous to the cause of progressive therapeusis of diseases of the alimentary canal, about one-third of which are surgical, than the common failure to combine these two departments of medicine. Naturally and properly interlocked, they are too often kept dissociated or even at variance by unfortunate prejudices or failures in cooperation.

For the well-defined, basically medical cases of colitis many rational and successful forms of treatment have been devised. There remain, however, some which may properly be looked upon as borderline in type. It is in this rather small group that the occasional use of medical therapy for the purpose of aiding in final diagnosis is justifiable. It is unnecessary to emphasize the fact that the abdomen must never be opened unless in the experience of the observer definite good is to result. Patients upon the border of intestinal invalidism

face two types of mortality: that arising from action based upon surgical intervention, and that arising from delay. The former is well recognized and is properly charged to the surgeon. The latter is known but is rarely discussed. When we shall have learned to recognize the great frequency with which the pathogenic colon destroys life through secondary destruction of vital organs there will be less delay in attending to the early diagnosis and treatment of colonic lesions.

The surgical cases fall into three general groups. The first includes those patients whose colons are distorted and damaged by omental deviants or other bands of congenital or acquired origin. If the dysmorphism is not too severe and particularly if not of too long standing, this form of pressure colitis can be permanently cured by simple section of the constricting membranes, including omentectomy. Obviously everything depends upon an early diagnosis, and it is therefore important that children be thoroughly studied, especially those whose parents or grandparents are known to have congenital colon dysmorphism. If the patient has been operated upon it is of course possible that chronic colon disease has been engendered by postoperative adhesions, but in our experience this is rare and does not occur unless a long postoperative interval has elapsed. We regard this as significant evidence that it requires many years to break down colon compensation and that the view is correct that a high degree of colon resistance explains the frequent absence of colon pathogenesis until the twenty-fifth year.

The second group comprises those patients with all types of megacolon, with or without evidence of pericolic adhesions. It is bad surgical practice ever to open the abdomen of such a patient without first having subjected him to an exhaustive course of medical hygiene and therapeusis. It is likewise bad surgical practice to open the abdomen of such a patient, electively, unless prepared to remove the

colon in toto. These patients are invariably damaged by less radical measures, such as the removal of the appendix or the liberation of adhesions. As a rule, adhesions are either absent or of little consequence.

The third group comprises those patients in whom the evidence arising from a synthesis of the historical and roentgenray data has proved the existence of well-defined colonic pathogenesis. Immediately upon opening the abdomen of such a patient the colon will be found to be compressed, dilated, contractured, angulated, axially rotated, one or all. There will be found deep hernial sacs at the bottom of which digitation and inspection will reveal a severe degree of atrophy of the wall. Microscopic study of such areas[15] will often show that all the coats except the serosa have been damaged or destroyed. Chronic localized peritonitis is often associated with the inadequate protection of this thin coat. This view is further confirmed by the observed fact that acriviolet dye, when introduced as an enema while the abdomen is open, has been seen to pass through such damaged segments of gut as above described in sufficient quantity to stain a piece of gauze which is gently wiped over the serosa. A colon so damaged will usually emit a fecal odor that can be detected some distance from the operating table. This is often as well defined as if the bowel had been punctured and is, in itself, an important justification for colectomy. Partial colectomy is rarely indicated because the mortality is nearly as great as that of total resection, and the results by no means as good. It is not unlikely that one reason for this lies in the fact that if a colon segment is left in situ there is a backwash into the small bowel, the ileocecal sphincter having been removed. This explanation is irrelevant in the case of partial removal of the left side of the colon in those cases where the disease is localized in this area, and it is interesting to know that the removal of left-sided segments leads to better clinical result than right hemiresection. The matter

of surgical technique is not relevant here, having been presented in a previous paper.[1]

When surgical measures are not indicated or when they are not feasible it usually will be found possible to map out a course of medical and hygienic therapeusis which, carefully followed, will succeed, at least in part, in effecting substantial though transient improvement. A frequent and discouraging reason for failure is the uncooperative attitude of the patient. Occasionally this is due to a congenitally subnormal intelligence, but more frequently it is the result of personality changes engendered by the colonic disease. In the latter case a heavy burden is placed upon the physician and he must develop a tolerant philosophy and insight; he cannot otherwise hope for any measure of success.

The influence of diet in the production of colonic pathogenesis is probably slight, therefore little can be expected from dietary therapeusis alone. A rational diet based upon the needs of the individual is of course necessary. It should as a rule be low in animal protein and should never exceed the caloric requirements of the patient. Narcotics, alcohol and laxatives should be withdrawn as soon as possible. Every effort should be made to overcome constipation without the use of laxatives excepting cold pressed castor oil, the occasional use of which in large doses is of great value. Belladonna is a useful palliative remedy, particularly in the long months of medical care following operative intervention. The use of iron or other drugs directed toward the alteration of abnormal blood pictures is useless excepting for a brief time. The so-called intestinal antiseptics are worthless with the possible exception of certain organic mercury compounds and a few aniline dyes, such as acriviolet. This inhibits both gram-negative and gram-positive organisms, penetrates some distance into the tissues and is relatively non-toxic. It must not be forgotten that it destroys B. acidophilus and should never be administered in conjunction with it. Acriviolet, to be effective, should be applied

in concentrations stronger than 1:1000. It has been found impossible to use it in colonic lavage in concentrations greater than 1:5000 and we do not regard this procedure as the one of choice. There are various methods advocated for its use by mouth and occasionally oral administration is very successful. We have used it in combination with agar, but are unprepared at this time to give an opinion as to the success of the method. It is of value in this form in certain types of ulcerative colitis, notably those in which the bacillus described by Bargen appears to be predominant and where the stools are mucopurulent, bloody and excessive. Acriviolet, as would be expected, is less definite in its effect on the various forms of pressure colitis where the primary cause of the disease is extracolic. It may be remarked here that the typical ulcerative colitis with which all are familiar is not necessarily associated with congenital defects but is, on the other hand, almost invariably related to infection in the oronasal cavity. These sources of infection must be removed before acriviolet or any other agent can effect substantial recovery.

Attempts to implant B. acidophilus upon the colon mucosa are not always successful. Even when successful, the benefit to the patient is not always noteworthy or permanent. In the face of gross deformities and pressure lesions in the colon wall, which as stated are extracolic in origin, B. acidophilus is useless. It is occasionally of value in counteracting constipation, but only where the colon is not deformed, congenitally or otherwise.

Autogenous vaccines capably prepared from predominant strains of .pathogenic colon flora are effective in the relief of symptoms but not in the cure of lesions. It is hardly necessary to state that anatomical abnormalities of the colon are not susceptible of any definite modification from vaccine therapy. However, we have noted a number of individuals in whom a functional improvement has occurred, as shown by our follow-up roentgenologic studies.

Whether or not the vaccine therapy is wholly responsible for such change we do not know, for other measures have been employed in conjunction with the vaccine. Nor is it known to what degree vaccines may be specific. Anti-sera for certain strains of B. coli and streptococci have been prepared and clinically studied over a number of years, but with the result that their value is still problematical. It is known that certain extremely toxic anaerobes are not infrequently found in the alimentary canal. Ten years ago Bull[16] developed an antitoxin for B. aërogenes capsulatus which was successful in the treatment of both local and systemic invasion of this organism. It is possible that such work as this may have far reaching effect in the treatment of obscure gastrointestinal disorders associated with anaerobic parasitism.

Colon lavage, so widely in vogue, is useful in old people. It is also frequently harmful, leading to added dilatation where dilatation already exists and in one case under our observation to sudden death from perforation. And yet this measure, supposedly harmless, is widely used and not always under medical direction. Artificial abdominal support or corseting is used with two objects in mind. Multipara with divulsed recti certainly need support and are benefitted by it. The same applies to any weakening of the abdominal wall which is not amenable to surgical correction. The second indication is the mitigation of definite ptosis of any intra-abdominal viscus, providing this can be achieved. If appliances do not afford positive support they are not only useless but usually detrimental. The use of physiotherapy is being much indulged in of late. We have no animus with regard to it if used rationally. The value of the intensive use of actinic radiation to the point of inducing excessive pigmentation and exfoliation of the skin of the abdomen is open to question. Medical diathermy, so-called, is a symptomatic form of treatment so far as the chronic and persistent infections are

concerned. In other respects we have no arguments against it and none for it.

We have long felt the want of comprehensive and correlated research relating to the problem of colonic function and pathogenesis. Much has been written about the isolated infections, neoplasms and functional disturbances of the colon, without any attempt having been made, so far as can be found, either to correlate the whole subject upon an anatomical and physiological foundation or to consider disease of the colon in its fundamental and all-important bearing upon somatic disorders. Casual discussion of these problems with able practitioners of medicine has frequently evoked interest, but a constructive response only rarely. The birth of an idea is laborious. We are particularly grateful to those of our medical associates and friends, notably Dr. James Ewing, whose open minds and helpful criticism have from time to time stimulated and reinspired a work which cannot be carried on except under great difficulty, for the course is uncharted and the path easily lost.

CASE REPORTS

CASE No. 6143. Male, aged thirty-one. When ten years old, had scarlet fever complicated by nephritis, and a long convalescence. Patient had no recollection of intestinal trouble or constipation during childhood other than a severe attack of diarrhea lasting a month at twelve years of age. In the same year he had pneumonia followed by persistent bronchitis which continued throughout adolescence. During his second year at Yale his appendix was removed because of severe abdominal pain. It is important to note that the involvement of the appendix was negligible. From his nineteenth year on, while in college, he began to be troubled with constipation, and he was obliged to leave college for a year because of a "nervous breakdown." This developed into a mild psychosis with depression, suicidal thoughts and a religious trend. *Constipation became progressively severe.* Because of unusual aptitude he graduated with Phi Beta Kappa honors. At twenty-six he was obliged to give up his studies in a theological seminary because of a "nervous breakdown"

similar to the previous attack. At this time he lost thirty pounds in weight. He spent three years in Colorado seeking to regain weight and health without success. At thirty, following a pulmonary hemorrhage, he was found to have tuberculosis. He went to Saranac for a year. It is interesting to note that he gained ten pounds during the first six weeks and then developed "indigestion" with loss of all the weight gained. He was first studied by us during the summer of 1925. Roentgenological diagnosis was as follows: chronic segmental pressure colitis tending to become generalized; evidence of knotting and constriction at the splenic flexure; obstructive pressure lesion orad to hepatic flexure; probable bilateral omental deviation; chronic tuberculous infiltration of lungs, both upper lobes; sputum positive. Patient returned to Saranac in November 1925 following an attack of pleurisy. Intensive actinotherapy at Saranac, leading to extensive pigmentation, dessication and exfoliation of skin of entire abdomen.

Total colectomy June 4, 1926. Aside from the colon itself the principal pathological condition was an extensive mesenteric adenitis. No milliary tubercules were found. The splenic flexure was bound down by a left omental deviant, there being less marked omental involvement of the hepatic flexure (Fig. 4). The middle portion of the omentum was atypical. Excision of entire colon with about 15 cm. of terminal ileum; mesenteric marsupialization. This patient has had no gastrointestinal symptoms since the operation. Examination of the chest and sputum have been negative for active tuberculosis. By the third month after operation the patient's mental condition had begun to improve and he began to read not only ordinary books but also Greek. He stated that the entire twelve years since graduation had been more or less of a blank, but that he now felt almost as alert mentally as during his early days in college. Strong hereditary history (Figs. 4, 5 and 6).

CASE No. 4950. Female, aged twenty-three. First examination October 25, 1922. She complained of loss of strength and constipation, and was extremely apprehensive about traveling alone. She had had bilious attacks from early childhood. These had ceased at about the eighteenth year, only to be followed by severe headache and vomiting. She had been constipated from childhood until the nineteenth year, at which time she had an

attack of "intestinal indigestion" followed by diarrhea. Subsequently the bowel condition became very irregular. The x-ray showed a severe colitis with right pericolic membranitis.

Total colectomy November 15, 1922. There was a very severe mesenteric adenitis which in the opinion of Andrew Todd McClintock, our pathologist, might easily have been mistaken for status lymphaticus. Marked dysmorphism of the bowel was found, together with serious pressure colitis. Obstructive pericolic bands over the ascending colon and the splenic flexure were present. Those on the right side were recognized as omental, in part at least. The entire bowel was removed by the older technique, that is, without mesenteric marsupialization.

This patient has had complete arrest of her symptoms, and has recently travelled through Europe alone.

Case No. 4931. Male, aged twenty-five. This patient presented a definite history of gastrointestinal disorder for fifteen years. He was referred from the Department of Health in New York City as a hopeless and helpless derelict. He has now been operated upon 9 times, twice in Antifogasta, the remaining 7 operations having been done by us. As so often happens in the surgical treatment of gastrointestinal invalids, the relatively useless operation of appendectomy was done first, to be followed shortly because of lack of improvement by attempted hemi-exclusion of the right colon. This so far as could be learned was the condition which obtained when the patient reached New York. He rapidly deteriorated and was little more than a skeleton at the time of the third operation. This was *total colectomy*, October 1922. The colon was in an advanced state of degeneration due to densely contractured pressure membranes. The hemi-excluded segment was packed with dry fecal material, an invariable sequel to a procedure which so disorganizes function. Following this the patient developed a duodenal ulcer which necessitated gastroenterostomy. In spite of the fact that all oral sepsis was carefully treated, a marginal ulcer developed upon the site of the stoma. A number of palliative surgical efforts were made to heal this without satisfactory result and it was finally resected together with a further considerable portion of the pyloric antrum. A noteworthy observation on this patient and

one which we have confirmed on many occasions is that extensive adhesions rarely occur within a colectomized abdomen in spite of numerous operations. There is much reason for believing that a proportion at least of the usual postoperative adhesions originate from colonic transudations.

This patient is free from abdominal pain for the first time in sixteen years, has gained thirty pounds in weight, and is studying architecture.

Case No. 4281. Male, aged twenty-one. This patient was a drug clerk, and because of his habitual use of castor oil had become the butt of ridicule for all his fellow employees. It was a common joke in the store that his troubles were imaginary and all located in his head. One year prior to our first examination he had been sent to Fordham Hospital for the relief of a severe impaction of the bowel. It is important to note that although over twenty years old he had never progressed beyond a boy's equipment mentally. He was able to do up bundles and run errands and was paid twelve dollars a week. He was sallow, pale and nervous and had constant abdominal pain. Roentgen-ray studies showed an immense dilatation of the cecum together with persistent gastric and colonic retention. On May 8, 1916 the right colon was removed. There was a particularly heavy pericolic veil which held the ascending colon in marked angulation. When liberated the cecum came into view, presenting a mesentery of unusual length and continuous with that of the ileum. Although the condition of the patient was improved with regard to the constipation, he was still inclined to be drowsy and to suffer from the severe toxic headaches which had constituted a large part of his general disability. In May, 1919 the pelvic colon was resected. In April, 1921 the improvement in this patient's condition was reflected by his promotion in business. The disabling toxic headaches ceased. For several years he remained in a more or less stationary condition, never being quite well, until further study revealed the presence of extensive oronasal sepsis, notably in the sinuses. Following the radical treatment of these conditions he has made a complete recovery and is now a successful business man.

Case No. 3940. Male, aged forty-one. This patient, while well educated and of fine family,

had never worked and was unsuccessful in his profession. He was little given to complaining and was regarded by his friends and relatives as being mentally and morally incompetent. He had suffered since boyhood from chronic and persistent constipation. After a friendship of many years, he confided to both of us that he had always felt himself to be inferior and incompetent and that in order to face the requirements of life he had found it necessary always to resort to the use of alcohol, and more recently to narcotic drugs. It was known that he had been addicted to alcohol since before his twentieth year. He confessed that he had also become addicted to the use of cocaine and morphine, besides having experimented with every other form of narcotic drug. He found that laxatives and purgatives were absolutely inefficient unless bolstered by the relaxing effects of profound narcosis. Roentgen-ray examination of the alimentary canal disclosed one of the most typical examples of bilateral omental deviation that we have ever seen, with secondary degeneration of the entire colon (Fig. 1). The patient requested that his colon be removed, and upon being told that he was a bad risk on account of the presence of advanced myocardial changes, replied that he would be better off dead than alive unless he could be relieved of the physical distress and mental depression incident to his condition, and that he considered this directly the result of his having been unable for many years to empty the right side of his colon.

Total colectomy was performed in 1924. On opening the abdomen the posterior surface of a large mobile cecum presented, the middle of the ascending colon being so adherent to the floor of the right abdominal gutter that it could not be mobilized without section of the dense overlying fibrosed omental tissue. This had served to approximate the cecum and hepatic flexure through a longitudinal pull coupled with extreme pressure on the middle portion, and accounted for the distortion of the cecum. The cecum was packed with fecaliths harder and more compact than usually seen. The omental insertion in the ascending colon was continuous with a heavy fat-bearing band which crossed the duodenum to find attachment on the liver and gall bladder. Similar omental deviation on the left side caused constricting angulation of the transverse colon, and distortion of the splenic flexure with

abnormal attachment to the spleen. This patient had megacecum, although the roentgen-ray did not disclose it because of the compression and distortion. Stormy postoperative history due in large part to enforced withdrawal of alcohol, and difficulties attendant upon the administration of morphine and cocaine in correct dosages. Surgical recovery, but followed by death on the fifteenth day, with symptoms of delirium tremens and cardiac insufficiency.

The son of this patient also has a pronounced megacecum (Fig. 3) and was observed by one of us in an attack of petit mal.

CASE No. 3893.   Female, aged thirty-nine. This patient was evidently born with a dysmorphic or over-sized colon. At the age of two she was seriously ill with acute bowel impaction. From her seventh year on she remembered having been frequently ill and having to lie across a chair because of pain. The condition was called "catarrh of the bowel." Until her eleventh year she had been able to attend school for less than one complete year. In spite of this chronic invalidism she entered college at seventeen and graduated in three years with Phi Beta Kappa honors. While studying for the degree of Doctor of Philosophy in the University of Pennsylvania she had frequent attacks of severe abdominal pain, often leading to hospitalization. The outstanding symptoms were frequent sore throat, otitis media, cervical adenitis, migraine relieved only by castor oil, obstinate constipation with intercurrent attacks of diarrhea, vomiting due to gastric retention and attacks of palpitation and bradycardia often associated with extrasystolic arrhythmia. The appendix was removed in 1907. In 1916 there was done in Philadelphia an ileosigmoidostomy together with resection of the ascending colon. The improvement was transient. The patient first presented herself at this office in 1921. She was evidently suffering from very grave toxemia of intestinal origin. Roentgen-ray studies disclosed dilatation of and prolonged retention in the excluded blind segment. There was also severe dental infection and chronic disease of the paranasal sinuses. These latter conditions were alleviated by surgical measures before the major abdominal procedure was undertaken. In July, 1921, the excluded segment, comprising about 2½ feet, was resected. It was more than half filled with fecal masses which were moderately soft

near the anastomosis, but became progressively harder in the transverse colon, and near the occluded end of the transverse colon felt like concretions. The anastomosis then existing, although unusually large, was not disturbed. Gradual improvement in the abdominal condition was interrupted a year later by an acute pyelitis necessitating tonsillectomy and conical enucleation of the cervix. While still convalescing, a severe recurrence of the antral infection with secondary glaucoma developed. This was accompanied by such rapid increase in intraocular tension as to require immediate and continuous drainage. This was established by iridoencleisis. The patient had been almost blind. Following the radical surgical treatment of the antra there was a gradual improvement in the symptoms so that the patient's vision is now 15/20. About six months later she developed subacute intestinal obstruction requiring laparotomy. A band was found compressing the bowel near the stoma. Thereafter the patient's improvement was slow but became more and more rapid following a minute dose of colon streptococcus antiserum which had resulted in a severe and almost fatal attack of anaphylaxis occurring on the fourth day. The patient is now, one year later, in better health than at any time since her childhood.

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CESAREAN SECTION
SOME RECENT MODIFICATIONS IN TECHNIQUE

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CINCINNATI

ONE of the notable features of obstetric practice during recent years has been an increase in the number of cesarean sections performed for other than absolute indications. Formerly this operation was utilized only as a last resort, and some obstetricians advised it only in the presence of extreme narrowing of the parturient canal. The tendency in recent years, however, has been to allow cesarean section to compete with other obstetric procedures in the management of dystocia due to causes other than extreme pelvic contraction, and also in meeting various obstetric emergencies.

Minor degrees of contracted pelvis, sufficient to delay delivery through the passages but not to make it impossible, are now recognized as relative indications for cesarean section when the interests of mother or child demand immediate cessation of labor. For the management of this type of case I believe that abdominal section is to be preferred to the use of high forceps. It is far safer for both mother and child and avoids those extensive lacerations which usually follow high forceps delivery. Having performed the operation eighty times during the past eight years, I have been much impressed with its greater safety.

Improved technique has made cesarean section a less formidable operation than formerly. I have devised a technique which, I believe, assures a cleaner operation and one less likely to be followed by infection than the so-called classical cesarean section. But, before describing my own operation, it will be of interest to review briefly some of the modifications of the cesarean operation that have been proposed during the last few years, in order that the reader may have a comprehensive idea of the situation.

THE SO-CALLED CLASSICAL OPERATION

Sänger in 1882 described an operation for cesarean section, to which we still adhere in principle, although it has been modified in details from time to time. It is therefore called the classical operation.

The patient is catheterized and a hypodermic injection of ergot given. The skin of the abdominal wall is prepared in the usual manner and ether anesthesia administered. An incision about 5 inches long is made in the linea alba, its upper end reaching almost to and a little to the left of the umbilicus. The initial incision should be small. It is completed by cutting the remainder with scissors guided by two fingers inserted into the peritoneal cavity. The uterus is carried to the median line and steadied there by an assistant. Gauze is packed around the fundus so as to prevent peritoneal contamination when the uterus is opened. Grasping the uterus with a volsella, the assistant holds it up against the abdominal wound. A longitudinal incision 5 inches long is made half through the uterine wall; then, with lessening strokes, the incision is completed so as to open the uterus. Using the scissors and two fingers, the operator enlarges the opening to the full length of the original incision. In this procedure he punctures the gestation sac, allowing the contents to spill. As the amniotic fluid gushes out, he searches for one foot and then makes a breech extraction with the Smellie-Veit maneuver on the after-coming head. The assistant presses against the sides of the abdomen in an effort to keep the fluid and blood from welling into the peritoneal

cavity; but it is, of course, impossible to avoid the leakage of a considerable amount of the liquid into the abdominal opening.

In the meantime, 1 c.c. of pituitrin is injected intramuscularly. The umbilical cord is clamped and cut as after normal delivery, and the infant is then handed to a second assistant. Usually the placenta drops into the uterine cavity, whence it may be removed manually; but care must be taken to pull gently in order to remove all the membranes. The uterine cavity is stuffed with a gauze pad, which is removed just before finishing the first row of sutures.

Beginning at the upper angle of the wound, the first row of stitches is inserted just beneath the endometrium, which must not be inverted into the wound. The second row is taken in the thickness of the muscle. Then the catgut ends are tied so as to leave one knot for the double row of sutures at each end of the uterine wound. The third row of uterine sutures begins at the lower end of the uterine incision; reaching the top, it turns back on itself, to come down along the peritoneal surface of the uterus and be tied as a second knot at the lower end. The knots must be tied firmly and accurate coaptation of the uterine wall is essential. It is sometimes advisable to add a row of interrupted sutures where apposition is difficult. Each row of uterine sutures buries the preceding row. The abdominal wound is closed as after ordinary laparotomy.

SOME RECENT TECHNICAL DEVELOPMENTS

So many modifications of the cesarean operation have been described that it would far exceed the scope of this paper to give credit to them all, but enough of the methods described in the last few years will be mentioned to give the reader a clear conception of the trend of modern technique in the performance of this operation.

The usual anesthetic, of course, is ether. Even in Europe, many operators are showing a tendency to abandon chloroform as being too dangerous. Nitrous oxide has proved unserviceable for this operation, because it fails to give the required relaxation and increases bleeding.

In patients classed as bad surgical risks, such as those with decompensated heart disease, tuberculosis, diabetes or nephritis, Irving[1] has recommended the performance of cesarean section under morphine and scopolamine combined with local anesthesia. This form of anesthesia helps to reduce the shock of operation to a minimum.

Astley[2] regards spinal anesthesia as the method of choice in cases of eclampsia, stormy nephritis, severe toxemia, pneumonia and other menacing conditions associated with a degree of dystocia that requires the performance of the cesarian section. Intraspinal anesthesia reinforces contraction and retraction of the uterus and has the advantage of almost total absence of hemorrhage and good postoperative recovery. However, one must expect an occasional death from the anesthetic. In Brindeau's[3] series of 232 cases there were 2 deaths from this source.

DeLee[4] favors the low, or cervical approach, an operation which he calls laparotrachelotomy. With this technique he had but 2 deaths in 330 operations. The operation is simplified, particularly if the patient has been in labor for a long time, by the fact that uterine contraction stretches the lower uterine segment and draws the cervix away from the bladder. The fascial incision is made 1.5 cm. to the left of the linea alba; then the rectus muscle is drawn from its sheath at the midline and the peritoneum opened extramedially. By this means the rectus muscle is mortised into the fascia when the wound is closed, serving to prevent subsequent hernia. The bladder, which is usually high on the abdominal wall, is pushed down and to the right. After dissection of the overlying peritoneum, the incision is made in the lower uterine segment. The face of the child is brought to the opening by means of a finger inserted into its mouth, and the infant is delivered chin first. The placenta may be removed manually or by Credé's

method. The uterine cavity is packed lightly with a strip of gauze and the wound in the lower segment closed by means of buried layers of sutures.

In performing transperitoneal cesarean section, Polak[5] makes a low abdominal incision. A traction suture is placed in the uterus at the upper limit of the abdominal incision, which, when held taut, occludes the wound perfectly. A peritoneal flap including the bladder is separated. The infant is delivered head first and the placenta allowed to separate spontaneously. To stimulate its contraction and retraction, the uterus is packed with washed iodoform gauze, which will usually be found extruded into the vagina at the end of twenty-four hours. The uterine wound is completely occluded by suture of the bladder reflexion over it, thus preventing the possibility of peritoneal leakage and intestinal adhesions.

Hirst[6] believes that no single operation is applicable to all cases in which cesarean section is employed. He advocates as many as five separate procedures, each of which may be used to best advantage under appropriate conditions. Hirst believes that the old classical operation with a long incision and eventration of the uterus, while easy to perform, is rarely indicated except when extraordinary exposure of the uterus and abdomen is required, as in central placenta previa, where immediate control of hemorrhage is essential. The short high incision with emptying of the uterus in situ and then eventration for purposes of suturing is best for the case definitely known to be clean and uncontaminated. Extraperitoneal cesarean section or low cervical cesarean is called for when previous contamination has occurred but there is not frank infection. The Porro operation, that is, abdominal hysterectomy with dropped stump, should be used when there are indications for hysterectomy, such as fibroid degeneration of the uterus. Abdominal hysterectomy with marsupialization of the stump in the abdominal wall and extraperitoneal drainage is indicated in cases which have been neglected in long labor

and in which there is great likelihood of infection.

The purpose of the operation described by Brodhead et al.[7] is to secure a quadrilateral area on the anterior surface of the uterus, through which the infant may be extracted, and at the same time to have this area excluded from the general peritoneal cavity. In order to secure this quadrilateral area, which measures 6 inches in length and $\frac{3}{4}$ inch in width, they suture the peritoneum of the anterior abdominal wall to that of the anterior surface of the uterus. Fully recognizing the dangers of the initial spill when the gestation sac is opened, Brodhead goes to elaborate pains to prevent the entrance of the fluid into the peritoneal cavity. As I shall show later on, the simple maneuver that I employ completely averts this danger.

Henkel[8] operates through a median abdominal incision, slitting the vesical peritoneum transversely and pushing the bladder and peritoneum downward as far as possible. The lower uterine segment is opened up by an incision through the middle of the cervix. The moment the cord is tied the suturing of the uterine incision is begun, working upward. When the suturing has been half completed, the placenta is separated by Credé expression from without and drawn out through the upper half of the wound. The incision is closed with button sutures 1 cm. apart, which do not pass through the mucosa. A running catgut suture is used for the serosa. When suturing the layers of the uterus, one must be careful not to allow any of the mucosa to catch between the muscular surfaces, and each layer must be coapted separately. Henkel has had such good results with this technique that he has greatly extended the indications for the cesarean section.

Rosenfeld[9] believes that drainage should be instituted in connection with cesarean section. He is of the opinion that peritonitis, when it does occur, is due not to the initial spill but to pathogenic organisms which invade the uterus about the fifth

day and migrate through the uterine suture lines to reach the peritoneum. He places a cigarette drain directly over the wound on the uterus, allowing it to emerge through the lower angle of the abdominal incision. This drain is held in position by looping a few interrupted plain catgut No. 0 sutures around it, the sutures passing through the subjacent anterior uterine wall. The catgut is absorbed in from twenty-four to forty-eight hours. Should it become necessary to remove the drain, there are no sutures after twenty-four hours to hinder its removal.

Von Reding[10] does not suture the uterus after cesarean section except in clean cases. He believes that to suture a uterus known to be infected is contrary to general surgical principles and can see no essential disadvantages in leaving the wound open. In order to assure drainage in cases known to be infected, von Reding uses several stout catgut loops tied through the edges of the wound on each side so as to hold the lips of the incision slightly apart.

As cesarean section is frequently performed nowadays in cases in which infection is not a serious factor, and hysterectomy is probably preferable in the presence of grave contamination, there does not seem to be much call for the procedure advised by von Reding.

A two-stage operation with an interval of twenty to thirty days between the stages is performed by Portes.[11] He modifies extraperitoneal cesarean section to the extent of leaving the uterus temporarily outside the abdominal wall after the infant has been removed. His immediate results in 10 cases were excellent. Portes believes that this method is indicated when it is too late for conservative cesarean section and either hysterectomy or cephalotripsy would otherwise be inevitable.

In performing the Porro operation, Proubasta[12] severs the vascular pedicles of the uterus, thus allowing more thorough packing with gauze to protect the peritoneum. In order to reduce shock as much as possible, he partly sutures the abdominal incision as soon as the uterus is drawn out of the wound, without waiting until hysterectomy has been performed.

AUTHOR'S TECHNIQUE

The aim of my operation is to avoid contamination of the peritoneal cavity and the uterine incision by the spill of fluid occurring when the bag of waters is ruptured within the uterus. To this end I have adopted the practice of delivering the infant within the gestation sac, avoiding rupture until it has been removed entirely from the operative field. This maneuver, I believe, removes one of the most serious dangers of the cesarean operation, namely, peritoneal contamination from the spill of fluid from the uterus. I am convinced that its greater safety will considerably increase the scope of usefulness of cesarean section.

The uterus is delivered through the abdominal wound by a rectus incision slightly to the left of the median line. The intestines and abdominal cavity are then walled off with saline gauze. The uterus is opened by an incision beginning at the bladder and extending sufficiently high for easy delivery. We feel that a low incision makes a more secure scar, but there is no advantage to making it longer than necessary.

Instead of rupturing the amniotic sac, I carefully strip the entire gestation sac from the uterine wall and deliver it en masse. So long as the placental circulation is maintained, there is no danger to the child from this procedure. This maneuver requires about one minute, although I believe five minutes would be perfectly safe. The sac containing the infant is handed to an assistant, who removes it from the vicinity of the wound, ruptures the membranes, extracts the child, and ties and severs the cord.

It might seem offhand that it would be difficult to separate the gestation sac from the uterine wall, but I have not found this to be the case. In eight consecutive cesarean sections performed according to

this technique without a death to mother or child, I have encountered no difficulty in effecting this separation.

Occasionally the placenta will be found lying beneath the uterine incision. I do not believe that this finding need occasion concern. In fact I search for it before incising, by means of palpation and stethoscope. There is less danger of rupturing the sac if the separation is begun with the placenta.

After delivering the upper portion, the assistant makes pressure on both sides of the uterus from below, expressing the gestation mass.

The uterine incision is sutured with buried layers of stitches in the usual manner. The abdominal wound is then closed without drainage.

It has been my experience that this operation is cleaner and more in accord with surgical principles than the ordinary procedures, and that it reduces the hazard of infection to a minimum. Because of its greater safety both for mother and child, I believe that this improved cesarean section should be given preference to the use of high forceps in the majority of instances, since it prevents the extensive lacerations of the birth canal usually following instrumental delivery and also avoids compression of the infant's skull.

SUMMARY

Recent improvements in the technique of cesarean section are greatly increasing the scope of this operation. Formerly used only as a last resort, it is now competing successfully with many other standard obstetric procedures. I believe that, in most instances, a modified cesarean section is safer for both mother and child than the use of high forceps. For the mother, it avoids the extensive lacerations of the birth canal usually incidental to instrumental delivery, and for the child, the dangers of compression of the skull.

An improved technique for cesarean section is described. The principal point of this operation is the delivery of the entire gestation mass, containing the infant, intact, and the opening of the sac away from the field of operation. By this measure peritoneal contamination from the spill of fluid is prevented. I have found that the separation of the gestation sac from the uterine wall offers but slight difficulty. In the eight successive cesarean sections in which this technique was employed, there were no deaths to mother or child.

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CLINIC OF
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INTERSCAPULOTHORACIC AMPUTATION FOR RECURRENT CHONDROMA

THE following is a rather detailed history of this case from the records. In a letter received from the patient a few days ago he says: "I am still above ground, am feeling perfectly well, only my shoulder, and I guess you know what the trouble is. You have kept me going for the last nineteen years."

I first saw this patient on March 10, 1902, when he was twenty-five years of age. His chief complaint was a large, hard tumor springing from the upper portion of the shaft of the right humerus (Fig. 1). This was first noticed three years previously and was without history of trauma. A gradual, steady increase in size was noted. A diagnosis was made of sarcoma and immediate amputation advised.

The patient then consulted Dr. J. B. Murphy and Dr. A. J. Ochsner, who gave him the same advice. Dr. B. Sippy suggested that biopsy be done before resorting to amputation. This was performed and acting on the report of Prof. W. S. Miller, of the University of Wisconsin, who stated that the growth was a pure hyaline chondroma, I removed the tumor mass.

Six months later several small nodules were noted in the operative area and were removed (Fig. 2). Again the pathological report was pure hyaline chondroma. Six months after this it was necessary to remove several more nodules.

I did not see this man again until August 13, 1906. He then presented a large tumor involving the entire operative area and extending into the axilla (Fig. 3). The size of the growth had increased rapidly during the preceding month and it was decided to do interscapulothoracic amputation.

Under ether anesthesia the middle third of the clavicle was first resected with a chain saw and the subclavian artery ligated in two places with No. 2 plain catgut, and divided. The arm was elevated to allow the venous blood to empty; the subclavian veins were then doubly ligated and divided. The nerves of the brachial plexus were injected with 2 per cent cocaine solution before division, and operation was completed according to the Berger method (Fig. 4). When the patient was removed from the operating room he presented some symptoms of shock which were quickly dispelled by an intravenous injection of 2000 c.c. of sodium chloride solution. Convalescence was rapid and uneventful and the patient was out of bed on the fourth day.

The pathological reports made on sections taken from various parts of the tumor mass were invariably the same: pure hyaline chondroma. Evidence of sarcoma was not found.

One year after amputation of the arm the patient returned presenting a single subcutaneous nodule 1 by 1 cm. in about the middle of the scar. This nodule was removed under local anesthesia. For thirteen years, from August, 1907, to June, 1920, the patient enjoyed perfect health and was free from any evidence of the disease. Figure 5 is his photograph taken twelve years after amputation.

In June, 1920, the patient reported that he had recently noticed a nodular swelling rather deep in the region of the scar on the shoulder. Under general anesthesia a semicystic tumor, 5 by 7 cm., was removed. The tumor was firmly attached to the first rib, so that it was necessary to resect the rib and the remaining end of the clavicle in order to remove the growth. The coincident traumatic

Roentgenologic examination failed to reveal any signs of metastasis. Under ether anesthesia, wide excision of all involved tissue was performed, including resection of the second and third ribs. Every effort was made not to leave any fragments or chips of the nodule in the wound. Bunting's pathological report was:

"Section of tissue shows a chondroma which is rather atypical and which I should

FIG. 1.   FIG. 2.

FIG. 1. March, 1902. Large, hard tumor at the upper portion of the shaft of the right humerus. Biopsy revealed the growth to be pure hyaline chondroma.

FIG. 2. September, 1902. Six months after the removal of the growth several small nodules were noted in the operative area.

pneumothorax was well borne by the patient. The pathological report on this specimen from Dr. C. H. Bunting, of the University of Wisconsin, reads:

"Section shows an invasive growth into muscle and adipose tissue of irregular masses of atypical cartilage cells with poorly formed matrix. The typical appearance of actively growing chondrosarcoma, that is, polymorphous and spindle cells, were not seen. Malignancy evidently low."

On February 17, 1921, the patient again came to me for examination and two nodules each about 2 by 3 cm. were found apparently attached to the third rib.

expect to recur, although it does not show typical sarcomatous change."

The gross appearace of this last specimen differed somewhat from that of those removed at previous operations in that in places the consistency of the mass varied from pure hyaline to semigelatinous material.

On June 8, examination of the patient revealed a palpable swelling about 3 by 5 cm. on the posterior aspect of the upper thoracic wall. At operation the mass was found to be in the muscle tissue and was not attached to, or connected with, the ribs. Dr. Bunting's pathological report was:

Section of tissue shows several large (microsopically large) masses of irregularly formed cartilage with atypical cells. From these larger masses there are numerous projecting tongues of similar cells invading the voluntary muscle and adipose tissue. Several islands of similar character are found at quite a distance from the larger masses. Hence, an invasive atypical cartilaginous growth, a chondrosacroma which from the microscopic picture, one would say was of relatively low virulence, even without the history.

tumor was an enchondroma, but I do not know any enchondroma that occurs in the soft tissues as he reports that some of the later tumors have been.

The question now appears to be whether he shall have further surgery or roentgen-ray treatment. To satisfy myself as to that I have just had him examined by Dr. William Allen Pusey. Neither he nor his partner, Dr. Senear, have any idea concerning the pathologic condition. They agree that further operation

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 3. August, 1906. A large tumor which had developed involved the entire operative area and extended into the axilla.

FIG. 4. Patient after Berger amputation.

FIG. 5. Photograph of patient twelve years after amputation of arm. He enjoyed perfect health for a period of thirteen years.

On receipt of this report the still fresh operative wound was reopened and 100 mg. of radium element was placed in situ. The position of the radium was changed every six hours until 2150 mg.-hours had been given, followed later in convalescence by thorough roentgen-ray irradiation of the entire area of amputation.

On October 31, the patient's home physician stated in a letter that two more growths had appeared and that the patient was greatly discouraged. On November 22, Dr. John Ridlon of Chicago, whom the patient had consulted, wrote me as follows:

I examined Mr. C. B. last night. From his story I have no idea of the pathology of the tumors. He reports that you found the first

seems useless and it is their opinion that roentgen-ray treatment may ultimately result in a cure of these tumors.

The patient was given another prolonged and intensive series of roentgen-ray treatments. As the size of the growth continued to increase, he became discouraged and he stopped treatment several months ago. For the past six weeks he has suffered intensely with neuralgic pains in the right side of the neck and he came here again seeking relief.

We found no evidence of cachexia. The patient was well nourished, and his physical development was excellent except for this one affliction. The roentgenologist found an extensive local recurrence encroaching

on the right posterior upper thoracic cavity (Fig. 6). On palpation an extensive multi-nodular mass was felt extending from the most prominent part of the scar of the amputation into the cervical region, where it assumed a more singular outline and was semicystic in consistency. Pressure on it markedly increased the painful sensations which the patient complained were constantly present. The growth was evidently

FIG. 6. At last examination the roentgenogram showed extensive recurrence of the chondroma in the right, upper, posterior thoracic cavity.

attached to and encroaching on the stumps of the cervical plexus.

The incision exposed the most prominent cervical mass, which was seen to have a rather dense fibrous capsule. On incising this (it was useless to attempt to extirpate it) the contents, which were apparently under pressure, gushed out in the form of a semigelatinous, granular substance the color of light currant jelly. By extending the incision into the lateral cervical regions I exposed branches of the cervical plexus which were attached to the capsule of the tumor. After injecting them with novocaine and absolute alcohol and dividing them, I felt that I had done everything possible to alleviate this man's suffering.

An additional interesting feature of this case is the fact that the patient belongs

to a "tumor family." During the nineteen years since I first saw him I have operated on seven other members of the family for the following conditions: father for adenoma of the prostate; one brother for chondroma of the finger; one sister, splenectomy for splenomyelogenous leucemia; one sister for adenomyoma of the uterus, and three sisters for fibromyoma of the uterus.

In connection with this case the question

FIG. 7. Section of tumor removed at the time of last operative interference.

has often arisen in my mind whether it would have been better to have amputated the arm in the first place; and yet, had I done this the pathological report of a pure hyaline chondroma would have given me an uneasy conscience. The interval of thirteen years during which the patient was apparently entirely free from the disease is an extremely interesting factor.

Dr. Bunting has kindly consented to discuss this case from the standpoint of the pathologist:

I can speak only of the character of the recurrences as the original tumor did not come under my observation. The recurrent tumors, however, show several noteworthy points. In the first place the tumor is made up of cartilage cells of a mature type separated by a hyaline matrix often poorly formed. While the cells are usually found singly and surrounded by a capsule of more recently formed intercellular

matrix, they may be found in pairs, as in normal cartilage. No typical groups of four cells were found. The cells vary considerably in size and in some the nuclei attain the size of giant-cell nuclei. At no place in the sections does one find the de-differentiaton into closely packed spindle or polymorphous cells so characteristic of the rapidly growing chondrosarcoma.

In its general mode of growth the recurrences differ from benign chondroma. There is no continuous cartilage mass as in a chondroma, but instead, small groups, islands, or strands of a few cartilage cells and their matrix, surrounded by a connective tissue stroma. In other words the tumor has a distinctly alveolar architecture. The invasive columns of cells at the edge of the growth suggest strongly the growing edge of a squamous celled epithelioma.

One has then in the tumor an alveolar chondrosarcoma with mature type of cell and with a marked tendency to invasive growth. The clinical history would indicate that no general metastatic growth had taken place, a feature probably dependent upon the marked tendency of the cells to secrete the cartilage matrix which has thus bound them together (Fig. 7).

OMENTAL CYST

This patient, a man aged fifty, a painter, registered at the Clinic stating that for the preceding five months he had had loss of strength associated with increasing sense of discomfort with bloating in the lower portion of the abdomen. For a while the bowels had been loose, but were then normal. At times he still had pain in the region of the bladder on urination. There was no increase in frequency or hematuria. Appetite and digestion were good, and there was slight if any loss of weight. There was no history of abdominal trauma.

Four years ago the patient came to the Clinic complaining of cramping pains in the lower portion of the abdomen. The illness began six weeks previously with an early morning attack of lower abdominal pain associated with constipation, nausea, and occasional vomiting. The pain was eased somewhat after the fourth day when the obstipation was relieved. The patient was in bed for four weeks on the advice of his physician who diagnosed the attack as partial intestinal obstruction due possibly to malignant disease in the colon. The patient still had more or less constant slight pain in the lower portion of the abdomen; the bowels moved three or four times a day. There was no blood or mucus in the stools, and no tenesmus. Roentgenograms at this time failed to show any suspicious filling defect in the colon. Proctoscopic examination was negative. Two months later the patient was entirely free from symptoms.

On examination the patient was sallow. He weighed 140 pounds. The temperature was 98.5°F., pulse rate 84, systolic blood pressure 160, and diastolic 90. There was a simple uniform enlargement of the lower half of the abdomen which extended to a point midway between the umbilicus and ensiform cartilage. On palpation and percussion the mass was unquestionably a collection of fluid in a confining membrane. The entire area of the swelling was dull to percussion with no evidence of intestinal coils intervening between the cystic swelling and the overlying anterior abdominal wall.

The testicles were normal. Rectal examination revealed prostatic enlargement, Grade 1. No residual urine was passed through the catheter; the mass remained as before. Cystoscopic examination revealed the capacity of the bladder as normal. A well-defined prostatic bar was present with a generalized intravesical prostatic enlargement. It was not possible to catheterize the ureters to obtain pyelograms.

Urinalysis showed specific gravity 1.012, neutral reaction, trace of albumin, and no sugar. The return of the combined intravenous phenolsulphonphthalein test was 60 per cent.

Blood examination showed 80 per cent hemoglobin, 4,420,000 erythrocytes, and 9850 leucocytes. The Wassermann reaction was negative.

This case presented a large cystic tumor of the lower half of the abdomen without any very pronounced clinical symptoms

which would permit a positive diagnosis although the most probable lesions suggested are omental or mesenteric cyst or cyst of the urachus. Exploratory laparotomy was indicated.

Operation. Nitrous oxide and ether anesthetic was used. An 8-inch right paramedian suprapubic rectus incision was made. On opening the peritoneum I found immediately beneath it, and slightly

FIG. 8. Sac partially filled, showing its origin from omentum.

adherent to it, the bulging cyst wall. This was exceedingly thin in places and through it could be seen the dark amber-colored fluid contents. A trocar and cannula were introduced and 2000 c.c. of dark amber, slightly turbid odorless fluid were withdrawn and the trocar opening closed with a clamp leaving about 1000 c.c. of fluid in the sac which was unilocular (Fig. 8).

By gentle use of the finger, covered with gauze, the sac was readily freed from the slight adhesions to the anterior parietal peritoneum. At its pelvic end this sac was so firmly adherent to the dome of the bladder that it was necessary to use scissor dissection. It was also necessary to use some traction and more forcible action of the gauze-covered finger to free the posterior wall of the sac from its adhesions to the posterior parietal peritoneum, especially in the pelvis and along both flanks. The entire sac was now outside the abdominal cavity, but was still suspended from its cephalad surface by a

markedly vascular membrane about 10 cm. broad. It unquestionably was the great omentum, that portion of it which hangs below the transverse colon. There was scarcely room to clamp and divide this structure, so closely did the colon approximate the cystic sac. We noted that there was no connection whatever between the umbilicus and the sac nor was there any evidence that this cyst had its source of origin in any retroperitoneal structure or vestigeal remnant. The omentum was clearly the only possible source of origin. The stomach, liver, gall bladder, spleen, and both kidneys seemed normal on palpation. The appendix was in a state of fibrous obliteration.

We placed the patient in the Trendelenburg position in order to inspect, and if necessary peritonealize, any raw surface. Just below the prominence of the sacrum my hand encountered a globular cystic mass about 3 cm. in diameter, quite firmly attached to the posterior parietal peritoneum. It was necessary to use scissor dissection to remove it. Its contents were more translucent and lighter in color than was noted in the large cyst, and the sac wall was not so well organized. At the very bottom of the pelvic cavity in the median line was another cystic mass about three times as large as the previous one. It was necessary to free it with the scissors. Both of these secondary cysts might have been in direct contact with the pelvic portion of the sac wall of the large cyst, as this sac wall looked rough and abraded.

Discussion. Dowd and Farrar in 1911 tabulated the cases of omental cyst reported in the literature (37) and reported 1 of their own. Ryan, reporting a case of cyst of the omentum in 1926, stated that since 1852 when Gairdner reported a necropsy specimen before the Pathological Society of London, only 44 cases have been reported in the literature. As a rule there are no characteristic clinical symptoms except the presence of the cystic mass. When this is of some size there are the

associated symptoms of a sense of weight and bloating, possibly with dyspnea on exertion. The presence of these symptoms in a man, if the possibilities of a greatly distended urinary bladder are eliminated, should suggest the probability of an omental or mesenteric cyst and lead to exploratory laparotomy.

DR. C. H. BUNTING's *report on the pathology of the specimen.* The specimen as received consists of four separate cystic bodies. The largest of these has been evacuated of its content which is a thin fluid with a slight chocolate color. The collapsed cyst is circular, 15.5 cm. in diameter. The next cystic body consists apparently of a collection of small cysts, the largest of which is oval, measuring 4 cm. by 2.5 cm. by 1 cm. This joins a similar oval cyst also 4 cm. long by 1 cm. in its other diameters. At the junction of these two cysts there is a third smaller cyst roughly 1 cm. in diameter. The third cyst is nearly spherical and is 2 cm. in diameter. The fourth specimen is a somewhat conical cyst measuring 1.8 cm. in width, 2.3 cm. in length, and 1.5 cm. in thickness. The largest cyst has evidently been removed from the omentum, tags of which extend partly around its circumference. There lead from this groups of large blood vessels which run around the cyst dividing it into quadrants. The surface of the cyst between these vessels is glistening and smooth. The wall of the cyst is opaque in its major portion. On incision the wall is found to vary in thickness from less than 1 mm. to about 3 mm. at its thickest part. These thickened areas are evidently fibrous and are stiff and unyielding. The inner surface of the cyst is not uniform. In general it is smooth and glistening but this inner membrane appears to be spread over thick branching trabeculae suggesting the appearance of the inner surface of the bladder with the muscular bundles showing through. On other parts of the inner surface one finds definite tags of fibrin and even false membranes of considerable extent which are but slightly adherent and can be lifted off from the underlying surface. This gives a roughened appearance to this part of the cyst wall. This area is also somewhat nodular and pigmented with a light brownish pigment. The other three cysts show points of attachment apparently to omental tissue. Small blood vessels and accompanying fibrous tissue run over their outer surface as in the case of the largest cyst. The walls of the cysts are extremely thin, almost transparent. The cystic content is fluid and colorless. The inner cyst surfaces are smooth and glistening. They appear to be free from pigment and fibrinous tags are not apparent.

The cysts were fixed in 4 per cent formaldehyde. Sections for histological study were cut from various parts of the large cysts and from one of the smaller cysts. On microscopical examination the general pattern of structure of the cyst walls was found to be quite uniform (Fig. 9), but there were many variations in details in different sections (Fig. 10). In general

FIG. 9. Cross section of sac wall (× 25).

FIG. 10. Cross section of sac wall (× 175).

the cysts showed a richly vascular, rather loosely construeted outer part of the wall consisting of cellular and fibrillar connective tissue in which adipose tissue cells were in some places included. Lymphocytic vessels were numerous in this part of the wall as well as blood vessels. The inner part of the wall in general appeared to be of a much denser type of connective tissue with unusual swelling of the collagenous matrix until both grossly and histologically it resembled somewhat a car-

hyalin masses and fibroblastic organization was taking place. There was evidence below this fibrin layer that repeated organization of the exudate had occurred and that surface cells had been included and had multiplied within the spaces of the collagenous organizing tissue. These included cells in some places formed sheets of three or four continuous cells extending between the collagenous fibers. In other places there were masses of these cells, some with single nucleus and others with
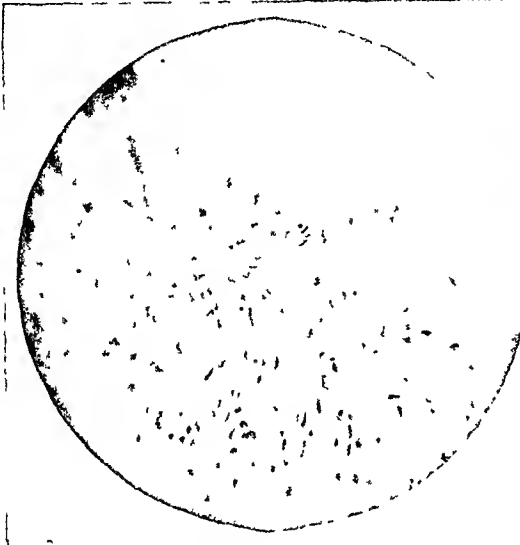
FIG. 11. Masses of fibrin on inner surface (× 175).
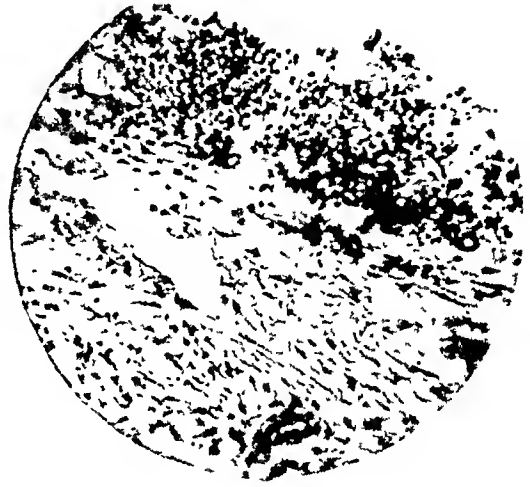
FIG. 12. Lymphoid infiltration, outer portion of cyst wall (× 175).

tilaginous matrix except that it stained with eosin rather than with hematoxylin. Where there was no fibrin on the inner surface of the eyst wall, the cyst was found to be lined with relatively large cells, with vesieular nuelei and with rather deeply eosin-staining protoplasm. In no places were these cells stretched out into thin flattened plates suggesting an endothelium. Instead they were commonly rounded, bulging toward the eyst cavity, or showed marked bulges over the nucleus. When desquamated they were in general of an oval shape with eentrally placed nucleus. There was, however, mueh variation in size of cell and in nuclear character. Some of the cells were decidedly of the giant-eell type with irregular, lobed nuclei. In seetions from certain portions these cells were found lying upon a dense fibrinous lamella. They were also surrounded by fibrin strands. Fibrin also lay to the inner side of these cells in some places (Fig. 11). In some places this fibrin had fused into dense

multiple nuclei in the individual cell bodies. In the smaller cyst this inner fibrinous exudate was in some places associated with an invasion by lymphoid cells and by a few polymorphonuclear leucocytes. In the outer part of the cyst walls beside a more normal fibroblastic growth there was marked infiltration of lymphoid cells about the blood vessels and chiefly about the veins (Fig. 12). In some sections there was fibrinous exudate on both sides of the cyst wall and a process smilar to that described for the inner surface was beginning to take place. Certain spaces in the outer part of the wall were lined by cells similar to those lining the inner surface of the cyst but in the main showing not so great deviation from the normal picture of the peritoneal mesothelium (Figs. 13 and 14). The endothelium of lymphatics and blood vessels appeared normal throughout. Phagoeytes eontaining red blood cells and pigment granules were found in small groups in both inner and outer parts of cyst walls.

Comment. The general character of the lesion suggests low-grade inflammatory origin resulting possibly in inclusions of peritoneal mesothelial cells which have assumed more or less of a neoplastic character resulting in extensive growth of the main cyst but without direct neoplastic invasion of the surrounding tissue. The invasion found is apparently the result of inclusion within the continuously organiz-

occasional vomiting during attacks and the temperature rose to 103°F. For three months during the previous summer she had been free from attacks; at the time of registration she was just recovering from the last attack. There were no urinary complaints; the bowels were regular. Menstruation had not started. Physical examination revealed nothing unusual except for the presence of a tense cystic mass which
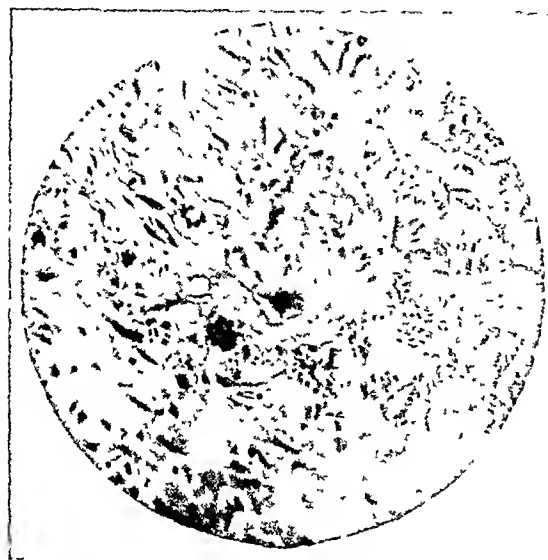
FIG. 13. Inclusion of peritoneal mesothelial cells in dense inner part of cyst wall (× 175).

FIG. 14. Peritoneal inclusion, outer wall of cyst (× 25)

ing inflammatory fibrinous exudate rather than a true progressing invasive growth. The normal state of the lymphatics of the part in addition to the general character of their lining cells appears to lend no evidence to the theory that these cysts are of lymphatic origin.

LARGE CHOCOLATE CYST WITH CONGENITAL ATRESIA OF VAGINA IN A GIRL AGED FOURTEEN

This patient came to the Clinic on October 4, 1927, with the following history: Approximately every six weeks for the past year she had had attacks of severe lower backache accompanied by lower abdominal and pelvic pain; at times they were dull and again they were so severe as to require morphine; the attacks usually lasted for from three to seven days. There was

filled the pelvis. This was detected by rectal examination; the hymen was intact. Diagnosis was made of ovarian cystoma, probably dermoid, and operation was advised.

Operation was done on October 6, by suprapubic median incision. On opening the peritoneum a large, black, cystic, pelvic mass was seen through the transparent layer of the great omentum which was quite firmly adherent to it. On first examination it was thought to be a strangulated ovarian cystoma. After freeing the omentum the mass was lifted out of the pelvis and found to be a typical huge chocolate cyst of the left ovary, 8 by 15 cm., which completely filled the left side of the pelvis, and then curved over the fundus of the uterus. A left salpingo-oophorectomy was done. The operating record states that the right ovary was about twice the normal size, and was covered with a layer of cells which

obscured its usual surface markings. The uterine fundus and right fallopian tube seemed normal. No other deposits of endometrial tissue on the peritoneum were noted. Convalescence was uneventful, and the patient left the hospital at the end of two weeks.

On November 15, four weeks after leaving hospital, the child was readmitted. She had felt well and had gained 5 pounds. At
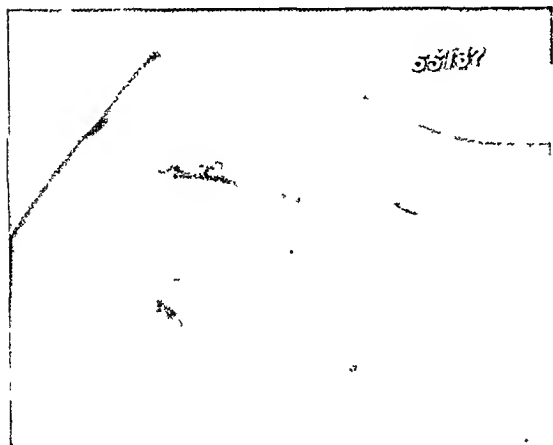
FIG. 15. Lower third of scar elevated due to endometrial graft development in abdominal wall.

3 A.M. on the day previous to readmission the child called her mother and stated that she was having an unusually severe attack of pain similar to those she had had before. The family physician was called and he administered morphine. He made a rectal examination and found a tense fluctuating mass that filled the lower portion of the pelvis. The patient at that time drew attention to the presence in the scar of the recent operation of a hard tender lump. The scar of the former operation presented an unusual condition (Fig. 15). The lower third of the scar was dome shaped and on the crest of this swelling the scar tissue was thinned out and transparent over an area of 1 by 3 cm., revealing a dark, almost black substance under tension below the thinned-out scar tissue. On palpation an indurated area was noted as occupying the dome-shaped elevation in the scar, an area about 7 by 4 cm. This was undoubtedly an endometrial graft development in the ab-

dominal wall due to the implantation of cells from the chocolate cyst during the operation for its removal about six weeks previously.

A tense semicystic mass was found in the pelvis on rectal examination.

At the suggestion of my colleague, Dr. C. S. Harper, before proceeding to perform laparotomy, we examined more carefully under general anesthesia the condition of the vagina. There was an extremely dense imperforate hymen and it would be necessary to perforate it. There seemed to be no vaginal cavity, the hymen being backed by areolar tissue into which by block dissection I inserted my finger a distance of an inch or more. We packed this with iodoform gauze and proceeded with the laparotomy. To excise the scar I made an elliptical incision to include the indurated mass. This was filled with tarry fluid and clots, which came from a smoothly lined cavity, about 3 by 6 cm. surrounded by a bacon-like wall of induration involving the rectus muscle. The entire mass was removed; it was completely extraperitoneal. On opening the peritoneal cavity, we were surprised not to find another large chocolate cyst. The uterine fundus stood erect and tense, and was unusually large for a girl of fourteen. As we followed the outline of the fundus downward there was an unusual change in its contour so that it roughly resembled an hour-glass. The lower bulging portion was tense and semicystic on palpation, and extended considerably deeper into the pelvis than would be suspected from inspection alone. The right ovary was in the same condition as cited at the previous operation. The right fallopian tube appeared normal and pervious. There was no evidence of any bloody material having escaped through the tube into the peritoneal cavity nor of any endometrial grafts on the peritoneum or intestines. Presumably there was a condition of hematometra with congenital absence of the lower section of the vagina, due to failure of fusion of the two embryonic buds which give rise to it by a process of coalescence before birth.

From the comparatively great size of the cystic swelling which merged into the lower end of the uterine body I hoped that the upper portion of the vagina and the cervix uteri were normal in development, and that we might by continuing the approach from below reach them and provide an outlet rather than do a hysterectomy. Dr. Harper kept his hand on the uterine fundus while I dissected from below. After placing a

superior part of the cavity and Dr. Harper assured me the forceps were distinctly in the uterine cavity. I then undermined the marginal remains of the greatly thickened hymen and the adjacent skin for several centimeters, and by traction on the edges of the opening in the sac and blunt dissection of the tissues around it I was able to introduce a series of interrupted sutures of chromic catgut uniting the edges of the

Fig. 16. Cross section of wall of chocolate cyst. Implants a and b (× 25).
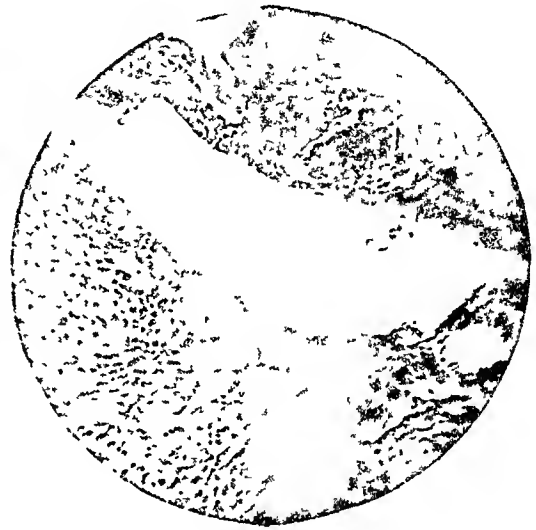
Fig. 17. Implant in wall of chocolate cyst (× 175).

catheter in the urethra by blunt dissection I enlarged the cavity in the tissues behind the hymen to a depth of about 7 cm. and I felt a tense bulging fluctuant mass. As I incised this there was an immediate escape of a column of black tarry substance, of such thick consistency that it retained its columnar shape as it continued rapidly to escape through the 1-inch opening I had made. There seemed to be an enormous amount of the substance, and as Dr. Harper squeezed the fundus uteri and more of the substance came through, the size of the fundus diminished appreciably. On inserting the index finger through the opening it entered a capacious smoothly lined sac. I could not find anything which resembled a cervix uteri, but the curved artery clamp with which I felt around entered an opening toward the antero-

hymen with the sac. A rather large pack of vaselined iodoform gauze was placed in the assumed vaginal canal.

From the large amount of dammed-up menstrual flow released it is apparent that considerable cystic swelling due to hematometra must have been present at the time of the first operation but was overlooked because of the great interest taken in the chocolate cyst.

Microscopic study showed endometrial implants in the tissue (Figs. 16, 17 and 18).

Discussion. Comments in the recent literature on the etiologic factors involved in the production of chocolate, or Sampson's, cyst point toward two possible methods of origin: (1) They may be due to congenitally misplaced endometrial cells; (2) they may be due to some condition in the uterine canal causing an obstruction

which permits the escape, during menstruation, of endometrial cells through the fallopian tubes to find lodgment in the ovary or peritoneal surfaces. The absolute obstruction to the escape of the menstrual flow in this patient is strictly corroborative of the theory of obstruction as a factor. The patient has had one normal menstrual period since the last operation and a practically normal vaginal canal is now present.

FIG. 18. Miniature endometrial cavity in wall of chocolate cyst (× 25).

ADENOCARCINOMATOUS CYST OF SPLEEN

This patient was a farmer's wife, forty-eight years old, and mother of four children; her youngest child was fourteen years old. The patient came to the Clinic three weeks ago complaining of a tumor in the left upper part of the abdomen, and of a constant sense of soreness in this region. She had noted the soreness for nine months, and the presence of the tumor for three months, before admission. The size of the tumor had been gradually increasing. The patient also complained of steadily increasing asthenia and of dyspnea on exertion with a feeling of continual weight and discomfort in the upper part of the abdomen accompanied by progressive anemia.

Menstruation had begun at the age of twelve. She had had regular four-day periods; the last period was six weeks ago.

She had been in good health until the present illness. There was no history of digestive disturbances, diarrhea, jaundice, loss of weight, fever, sweats, chills, or hemorrhages of any kind, nor of any genito-urinary disturbances. For some weeks she had noted transitory edema of the lower extremities.

Physical examination. The patient was fairly well nourished. Her weight was 134 pounds, pulse rate 86, temperature 100°F., respiration 24, systolic blood pressure 150, and diastolic 90. She was noticeably anemic. On examination the teeth, nose, and throat were found normal. The chest was also found normal. The superficial lymphatic glands were not palpable. The abdomen was somewhat distended, but there was no rigidity, and no evidence of ascites. In the upper left quadrant was a visible mass which on palpation and percussion was found to emerge from under the costal margin in the splenic area, extending to the median abdominal line and reaching to a point two inches below the level of the umbilicus. The mesial border of the tumor had the characteristic palpable outline of an enlarged spleen. The mass was dull to percussion and was only slightly movable, giving the impression of being firmly attached by its upper pole. Vaginal examination revealed a movable cystic tumor of the right ovary about 6 cm. in diameter. There was slight edema of the ankles and feet. The urine was amber colored, the specific gravity 1.016, and the reaction acid; there was no albumin, sugar, or bile. The Wassermann reaction was negative. The hemoglobin was 52 per cent; the erythrocytes numbered 2,850,000, and the leucocytes 3850: 56 per cent polymorphonuclears, 3 per cent large lymphocytes, 39 per cent small lymphocytes, and 2 per cent eosinophiles.

A probable diagnosis of splenic anemia or Banti's disease was made and splenectomy advised. At the operation which was made two weeks ago I found a tumor mass consisting of the spleen which was itself enlarged to four times its normal size, and

numerous cystic tumors varying in size from 1 cm. to 10 cm. in diameter; these were incorporated in and sprang from the splenic texture, while completely surrounding and firmly attached to the convex border of the spleen was a huge crescent sausage-like thick-walled cyst, the capsule of which was quite firmly adherent to the diaphragm for a considerable area (Fig. 19). The smaller cysts were quite translucent in places and lustrous with a yellowish green background.

On account of the markedly adherent condition of the large cyst to the diaphragm the splenic pedicle was ligated and divided before any attempt was made to free and mobilize the mass. On separating the adherent capsule from the diaphragm there was noted a rather ominous venous oozing in spite of the preliminary ligature of the splenic pedicle. This oozing was controlled by placing in situ a 5-yard hot salt pad as advocated by Balfour. No ascitic fluid was noted in the abdomen and there was no gross evidence of hepatitis. The gall bladder contained a single large stone. The tumor of the right ovary was examined only in a cursory manner and appeared to be a simple cystoma. It was not removed. Convalescence was satisfactory and uneventful.

One of the cysts was opened and found to contain a semi-gelatinous substance resembling in appearance and consistency old-fashioned wine jelly. The pathological condition was such an unusual one in our experience that the gross specimen was sent to Dr. A. C. Broders, Section on Pathology, Mayo Clinic. Broders reported that the condition was one of carcinomatous cystadenoma of a low degree of malignancy, which he believes was primary in the ovary with secondary invasion of the spleen. In view of this report we decided to remove the ovarian cystoma which was noted at the previous operation.

Operation. The abdomen was opened by a median suprapubic incision but the hand failed to find the globular mass of the cyst. It had ruptured and collapsed; there was some free clear fluid in the pelvis. The

sac was translucent and had the appearance of the wall of a simple ovarian cyst. Inside the sac where it sprang from the ovary there was a small amount of white gelatinous material (about 0.5 ounce) which did not at all resemble the material found in the splenic cystadenoma. The left ovary appeared to be perfectly normal. We removed it as well as the right one, inasmuch as there are undoubted cases on
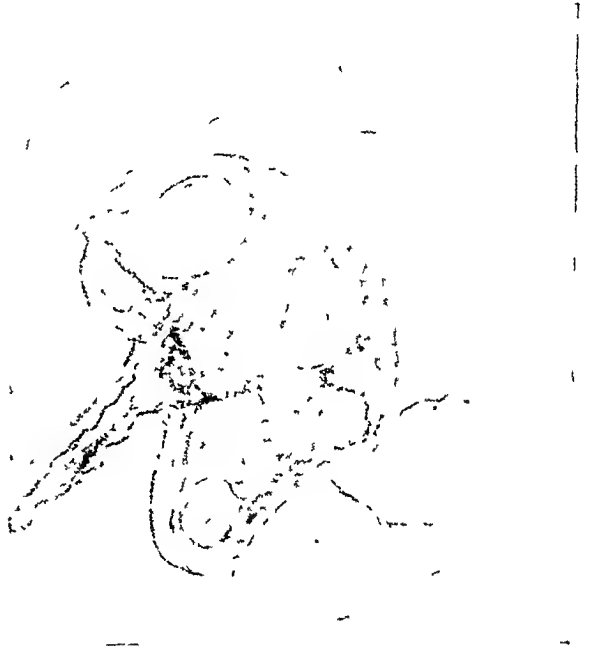
Fig. 19. Polycystic adenomatous spleen.

record in which advanced multiple metastatic masses secondary to carcinomatous ovarian disease have withered and disappeared following excision of the mother growth and ovaries, suggesting that some internal secretion of the ovary may be the exciting stimulus for the continued proliferation and growth of the daughter cells. There was no gross evidence in this case of any pin-head-sized or larger contiguous or metastatic growths on the fallopian tubes, uterus, peritoneum, intestines, or mesentery so generally found in cases of malignant ovarian cyst.

Note. Subsequent history shows that convalescence was uneventful. On June 10, 1927, eight years after splenectomy, the

patient reported at the Clinic for periodic examination. She stated that her general health since the operation had been good and that she had no complaints at this time. Physical examination was negative. The hemoglobin was 85 per cent; the erythrocytes numbered 4,590,000, and the leucocytes 9700; the color index was 0.7; 39.3 per cent of the differentials were polymorphonuclear neutrophiles, 57.3 per cent lymphocytes, 2.7 per cent transitionals and 0.7 per cent eosinophiles.

Discussion. Pathological examination of the ovarian cystoma and of the ovaries failed to show any evidence of abnormal cells except those characteristic of simple ovarian cystoma. If the opinion that the splenic tumor was probably of ovarian origin is correct, this carcinomatous cyst-adenoma of the spleen must be classed as one of secondary type, while failure to find any primary source of origin in the ovarian tissues throws doubt on this conjecture. It is possible that the primary area was overlooked in making the serial sections. The continued good health of the patient after a lapse of eight years eliminates the possibility that the splenic tumor was secondary to an undiscovered diseased third ovary as suggested at the time by another pathologist.

There is meager reference in the literature to splenic carcinoma. Textbooks mention its infrequency. Primary carcinoma of the spleen seems to be practically unknown and the apparent high degree of immunity possessed by this organ to metastatic neoplasm is emphasized by the relative infrequency of reference to the subject in the literature. The possibility of the lesion being of the so-called peritoneal inclusion type was considered, but discarded by the pathologists.

THE VALUE TO THE SURGEON OF
THE BASAL METABOLIC RATE
CONCLUSIONS BASED ON A STUDY OF 3085 REPORTS

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ONE of the questions most frequently asked relative to the subject of goiter is that concerning the value of the basal metabolic rate in determining the right time for operation. About five years ago one of the leading authorities on goiter stated that he had little or no confidence in reports from the metabolic laboratory and that he felt these tests were misleading. However, for one in his position who came in contact with many cases of goiter daily, clinical judgment might perhaps be more accurate than laboratory data, but for the physician whose experience is more limited, I maintained that the metabolic laboratory might furnish valuable information. Time has not altered my views; on the contrary, I find with added experience that the metabolic laboratory furnishes data that are indispensable for my work. There are, however, certain conditions bearing on the accuracy of these reports which I emphasized at that time and which I now repeat.

If the determination of the basal metabolic rate is to be of any value to the surgeon the following requirements must be met: (1) The metabolism machine must be reliable and in perfect running order; (2) the technician must be competent; (3) the test must be performed under proper conditions; (4) the test must be repeated one or more times in certain cases before it may be considered accurate; (5) the person interpreting the result of the test must be experienced and competent.

In this short dissertation I do not intend to discuss technical details relating to the laboratory, but merely to consider the clinical value of the metabolic test. Consequently it will suffice to say that while there may be reliable metabolic units with which I have had no personal experience, I do know that the determinations made with a number of outfits have no scientific value. A cheap unreliable metabolic unit is harmful in anyone's hands, because the results are not only misleading but may influence one's better clinical judgment. The metabolism unit employed at our Clinic, the Tissot gasometer (Figs. 1 and 2), is similar to that used by Plummer and Boothby, and it has always given absolute satisfaction. The principal objections to be brought against such a unit are the initial expense and the cost of a well-trained technician, but with such a laboratory one experiences the same satisfaction that he does from driving a well-constructed automobile. Undoubtedly a great deal of the criticism of the basal metabolic reports has resulted because of inaccurate determinations with poor machines. I have known high rates to be reported in cases of hypothyroidism, and low rates in cases of exophthalmic goiter. The greatest source of error is seen when abnormally high rates are reported in the case of normal patients. Even a reliable metabolic unit may prove unsatisfactory unless the technician is qualified for the position. With the Tissot-Haldane method the greatest accuracy is essential as I can testify from personal experience. Usually two tests are run and the percentage of error must not be more than one-half of 1 per cent.

If the patient has eaten, has been exercising, has a cold, a sore throat, or fever from

any cause, the test is not accurate. Likewise unduly nervous persons may have a high rate even when the metabolic machine and the technician are reliable. This error may be often avoided by first explaining the test to the patient and thus allaying any apprehension. In any case, when considering the possibility of exophthalmic goiter, unless the clinical symptoms are clear cut, too much importance should not

roentgenogram before learning to use one's eyes and ears. Before the surgeon uses a metabolic laboratory he should be so familiar with goiter cases that he can estimate the metabolic rate within 10 or 20 points of the laboratory reading.

CASE REPORTS

CASE I. The first patient represents a typical case of exophthalmic goiter in which
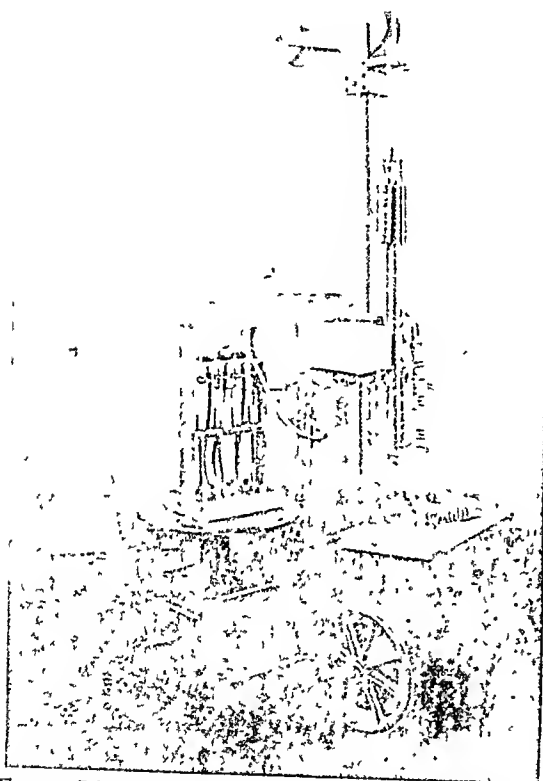
FIG. 1. Tissot metabolic unit, with Haldane analysis apparatus, used in determinations of these studies.

FIG. 2. Patient receiving metabolic test by Tissot gasometer method. Note tubes for intake and outlet.

be attached to any readings between plus 10 and plus 25 per cent. In case of toxic adenoma a rate of between plus 20 and plus 30 per cent must be considered significant. Whenever there is any doubt the test should be repeated one or more times.

The interpretation of the result of the basal metabolic rate is an important factor to be considered. For a surgeon to attempt to diagnose on the basis of a metabolic test before he is familiar with all the clinical phases of thyroid disturbance is like diagnosing chest lesions by means of the

conclusive evidence is furnished by the history and the clinical findings. This is the acute form of the disease, the patient having been ill only three weeks. The thyroid gland was visibly and palpably enlarged. Exophthalmos was marked, considering the short duration of the symptoms. The rapid loss of weight (30 pounds) together with the extreme restlessness, the high pulse pressure, and the onset of a gastrointestinal crisis, all suggested a severe form of the disease and a high metabolic rate. The patient was on the verge of a crisis and was in no condition for operation. (Figs. 3 and 4.)

This opinion was corroborated by a high metabolic rate of plus 78 per cent. After five days' preparation with iodine, forced diet, rest and sedatives, the patient's condition appeared remarkably improved and he might be considered ready for operation. A metabolic rate of plus 60 per cent at this time suggested, however, that further preparation was needed. Four days later the rate fell to plus 50 per cent and primary thyroidectomy was performed followed by uneventful convalescence. Experi-

after the patient leaves the hospital. Although three months after operation these patients may appear to be cured, I feel that they should for a time be considered in the same class as tuberculous patients that have recovered. They should avoid any mental or physical strain, should practice moderation in everything and thus by keeping themselves in condition guard against possible recurrence. I do not

FIG. 3. Basal metabolic rate in this case was plus 66 per cent. The acute onset and severity of symptoms were accurately indicated by the high rate.
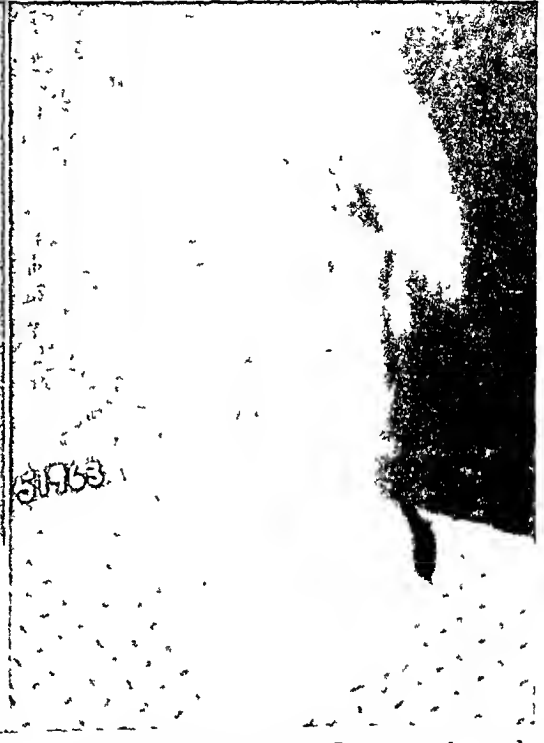
FIG. 4. Same patient as in Figure 3, six weeks after operation; the basal metabolic rate had come down to plus 2 per cent.

ence had convinced me that this patient had reached the maximum point of improvement but it was gratifying to know that the metabolic rate indicated that he was within the safety zone. Three weeks after operation the rate was plus 5 per cent, but the patient was considered neither cured nor dismissed from observation.

Comment. All these patients are placed on a careful postoperative regimen and kept under close observation for one or more years. If the metabolic rate returns to normal and there is a steady gain in weight and strength I feel that there is no indication to continue the use of iodine

believe in making chronic invalids of these patients, and our records indicate that more than 90 per cent of them resume their normal occupation, but I do believe it is possible to avoid recurrence in certain cases.

CASE II. The second type of case illustrates the chronic, mild, low-grade form of exophthalmic goiter. The patient complained only of slight nervousness and palpitation. The onset of symptoms had been gradual over a period of nine months. There was no visible or palpable enlargement of the thyroid gland, no thrill or bruit, and no exophthalmos, but slight tremor. The pulse rate was 92; the systolic blood pres-

sure was 120, the diastolic 78. There was no quadriceps loss; the skin was warm but not moist. The patient sat rather quietly. The history showed little that is significant. The patient's weight was perhaps 10 pounds less than normal. The appetite was good but not excessive. The symptoms were about as much in favor of, as against, the diagnosis of exophthalmic goiter. If, for instance, the three best diagnosticians in the country were to examine this patient they would probably not agree on

justified in advising operation. The patient was kept under close observation for four months. At times there was general improvement and the rate fell as low as plus 19 per cent and at no time did it exceed plus 30 per cent. Then, following a hot spell, the rate jumped to plus 46 per cent; the patient seemed keyed up; the appetite became excessive and she began to lose weight. In spite of the absence of most of the typical symptoms of this disease and the atypical history the diagnosis was evident.
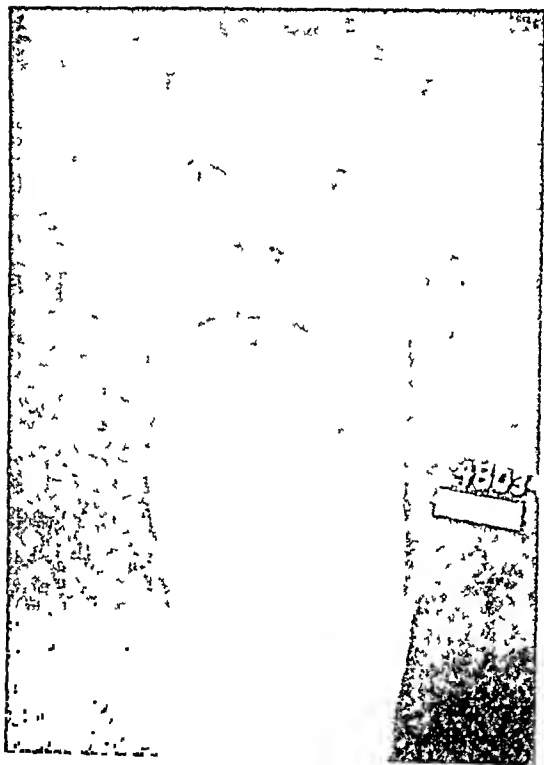
FIG 5. The basal metabolic rate in this patient was only plus 12 per cent, and effectively ruled out a possible diagnosis of hyperthyroidism.
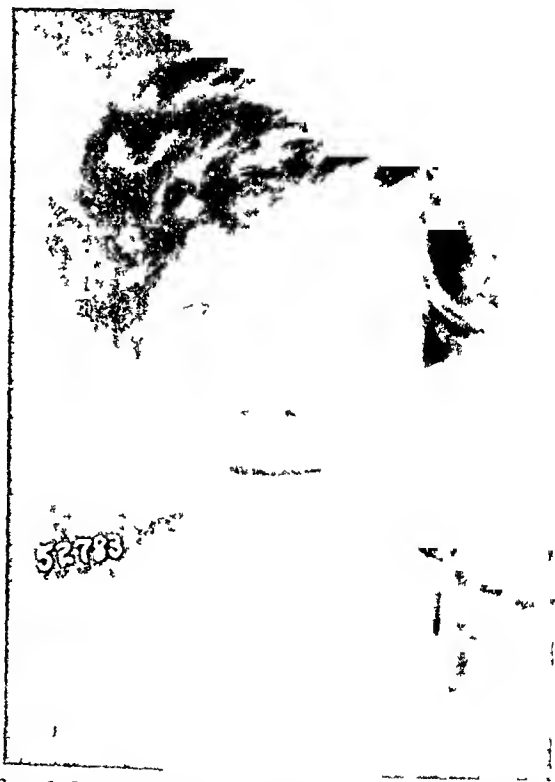
FIG. 6. In this case of exophthalmic goiter the patient had undergone medical treatment elsewhere for more than a year. The basal metabolic rate of plus 30 per cent is no indication of the damage to the cardiovascular system that had occurred.

the diagnosis. At this point it is perhaps well to repeat that an emergency operation is never indicated in case of exophthalmic goiter. The diagnosis should be confirmed beyond a doubt. On the other hand, once the diagnosis has been confirmed, delay in operating only results in grief to the patient and to the surgeon. In this case the metabolic rate of plus 30 per cent neither confirmed nor refuted the suspected diagnosis. The patient was given iodine as a therapeutic test but there was only slight response and the rate remained plus 25 per cent. Under the circumstances I did not feel

After three weeks' preparation with iodine the rate fell to plus 14 per cent and there was marked clinical improvement. At operation a rather large friable hyperplastic gland was found with only slight reversion to colloid. The appearance of the gland would seem to indicate greater toxicity in the clinical picture than was found.

Comment. I criticize myself for delaying thyroidectomy and yet I did not feel that the diagnosis was quite clear cut, and the

patient was given every opportunity to recover without operation. The results of the metabolic rate in this case consistently followed the course of the disease. The case is atypical and in my experience is one of the most puzzling and chronic I have seen.

CASE III. In the third case the reader may hazard his own diagnosis before reading the summary. The patient, aged thirty, had been in good health until six months previously.

help to know the basal metabolic rate. The possibility of thyroid trouble was entirely eliminated by a normal rate of plus 6 per cent. When lactation was stopped, and help and rest provided for the mother, there was marked general improvement. (Fig. 5.)

Comment. It is perhaps in these doubtful cases that the metabolic laboratory proves of greatest value. I consider a negative report such as this, made under proper
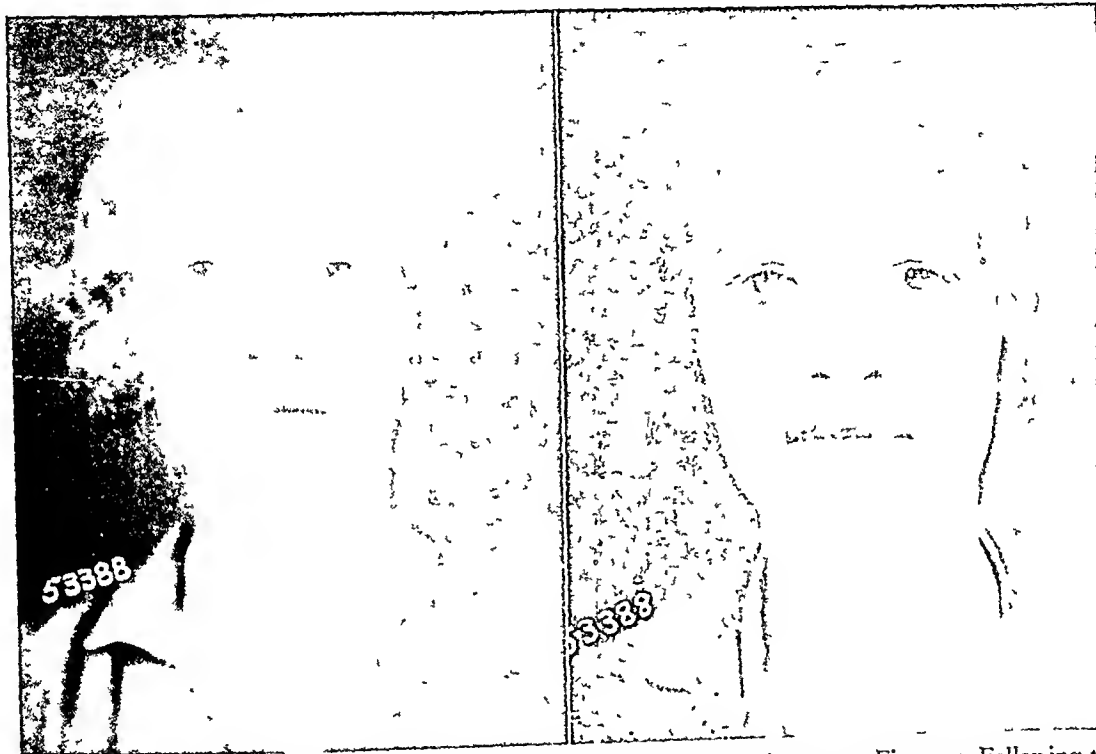
FIG. 7. This patient had a basal metabolic rate of plus 64 per cent. In this case it did not truly indicate the severity of the disease.

FIG. 8. Same patient as in Figure 7. Following the use of iodine the basal metabolic rate fell to plus 49 per cent. Three weeks after operation the rate was plus 8 per cent.

Following illness in the family and the birth of her child she had lost 35 pounds and had become weak and extremely nervous. The relatives had noticed slight prominence of her eyes and she had noticed weakness on climbing stairs, palpitation on exertion, and considerable dyspnea. Examination showed symmetrical enlargement of the gland with questionable bruit. The skin was warm and there was a slight tremor. The systolic blood pressure was 130 and the diastolic 80. The pulse rate was 96. The patient's uncle, who had recently recovered from severe exophthalmic goiter, brought her to the Clinic because her symptoms appeared to be identical with his. In such borderline cases as these I feel that it is a great

conditions, as conclusive evidence. In this connection I should like to mention that many persons come to me believing they have goiter; some of them have been advised to have an operation. I may tell them that the clinical evidence does not warrant an operation but I find that their confidence in the report of a metabolic rate is more staunch than in an opinion based merely on clinical examination. A normal metabolic rate is reassuring to the patient and to the physician.

CASE IV. The fourth patient, fifty-eight years old, had complained for the past two

weeks of general tremor of the entire body. There was little in the history or physical examination on which to base a diagnosis. The heart rate was remarkably slow, 78 beats a minute. The pulse pressure was increased, however, and there was marked tremor, with considerable fatigue and nervousness. While exophthalmic goiter was suspected, the pulse rate seemed to eliminate this condition. A metabolic rate of plus 56 per cent, rapid improvement on administration of iodine, and

FIG. 9. From general appearance this patient might seem to be suffering from toxic adenoma. A normal metabolic rate eliminated the possibility of hyperthyroidism.

the finding of a typically hyperplastic gland at operation, however, confirmed the diagnosis of exophthalmic goiter (Fig. 6).

Comment. In my experience with such cases this was the first instance in which I had seen these symptoms in association with such a degree of toxicity. It merely illustrates that daily experience adds to our knowledge and that the ridicule often directed against modern laboratory diagno-

sis may frequently be turned to triumph by the technician.

One day recently I found in my office a patient who evidently had exophthalmic goiter. There is something so characteristic about many of these patients that even a stenographer who constantly sees them can hazard an opinion. Most of you have heard the story of the big business man who vainly spent considerable time and money consulting leading specialists and finally had a bootblack in the vicinity of a large clinic tell him that the doctors would soon cure him of his goiter. In the case of my patient it was evident from her constant moving about that the thyroid was overactive. Some things about these persons are learned apparently only from repeated observation, facts that are not written in books and cannot be deducted from laboratory data. One learns to have considerable respect for the extremely restless, fidgety type of patient. The metabolic rate, which in this instance was only plus 64 per cent, does not truly express the severity of the disease, nor the degree of reaction that may be expected following operation (Figs. 7 and 8). Experience alone will aid in the analysis of such cases.

The metabolic rate may be plus 80 per cent in a person who has recently passed through a crisis. The rate may be falling and the patient improving. This rate is of less significance than one of plus 50 per cent in the case of a person on the verge of a crisis in which the disease is progressing rather than subsiding.

What is more gratifying than to watch a rate drop from plus 70 to plus 50 per cent during the preoperative period of preparation, and to normal three weeks after operation! Most of us feel that the patient is better after thyroidectomy when he himself says so, but it is a satisfaction to know by means of scientific data that the operation has proven successful and that we can usually give a favorable prognosis.

On the other hand, how disturbing it is to find that three weeks or even six weeks

after operation the rate is still plus 20 or plus 30 per cent. This information, however, may save the patient from further discomfort and the surgeon from embarrassment. It may mean one of several things. The patient is overdoing and not building up as he should. Even the remnant of gland left may have been so active as to cause persistence of hyperthyroidism. The surgeon may not have removed sufficient gland. If the proper amount of rest and the use of iodine are insisted on, the rate in a week's time may be brought within normal limits. Whether or not it will remain there and the patient recover his health can only be determined by a careful follow-up of the case and a study of the metabolic rates.

THE METABOLIC RATE IN CASE OF ADENOMATOUS GOITER

In the case of the adenomatous form of goiter the metabolic rate furnishes valuable confirmatory and diagnostic information. In general we know that persons less than thirty years of age who have adenomatous goiter have a normal metabolic rate and consequently the goiter is non-toxic. When the patient is more than forty there is an increasing tendency for such a goiter to become toxic. The onset of symptoms, however, is so gradual and insidious that the patient is seldom aware of his trouble. (Fig. 9.) I do not believe anyone can determine accurately in a given number of cases of this type whether or not the goiter has become toxic. It is in such instances that the metabolic rate is of great diagnostic value. It may be necessary to repeat the test more than once and to consider the information carefully, but as a rule the report is most helpful. If the rate is normal the possibility of hyperthyroidism is at once eliminated. If the rate is plus 25 per cent and the patient unduly nervous, a second test may show a normal reading. Even a single test with a reading higher than plus 30 per cent usually indicates hyperthyroidism. In my experience the

metabolic rate in cases of toxic adenoma rarely exceeds plus 65 per cent. In any case, when the rate exceeds plus 50 per cent I study the patient again to consider the possibility of superimposed exophthalmic goiter. If there is any doubt, iodine should be given since, if exophthalmic goiter is present, marked improvement may be expected. On the other hand, I have observed no benefit following the administration of iodine in cases of toxic adenoma.

A patient may be in an almost dying condition as a result of toxic adenoma and yet have a metabolic rate of only plus 30 or plus 40 per cent. The metabolic rate is not an index of the degree of cardiac involvement. In long-standing cases of toxic adenoma there is serious and permanent damage to the cardiovascular-renal system which of course is not registered by the metabolic rate. Consequently, in these cases the rate may merely confirm the clinical diagnosis, but in no sense should it be considered as a criterion of the risk of operability.

THE METABOLIC RATE IN CASE OF IODINE HYPERTHYROIDISM

Although adenomatous goiter does not of itself become toxic in the case of patients less than thirty years old, hyperthyroidism may be induced by the injudicious use of iodine. A number of cases of iodine hyperthyroidism in young persons has been observed at the Clinic. In many instances the metabolic rate did not exceed 30 per cent and by promptly withdrawing the drug, giving mild sedatives and advising rest it was possible to abort the symptoms. In other cases it was observed that the metabolic rate was as high as plus 65 per cent and in 3 instances fatality occurred in spite of all medical measures. The attention that has been directed against the promiscuous use of iodine in the case of adults having adenomatous goiter may possibly be the cause of the rapid decline in the incidence of this condition. A few years ago little attempt was made to differentiate

between the various forms of goiter, and iodine was freely administered for the adenomatous as well as the colloid type.

SUMMARY OF 3085 REPORTS

Table 1 shows an analysis of 3085 reports that have been made in our basal

TABLE I

CLASSIFICATION OF DISEASES IN WHICH BASAL METABOLIC RATE WAS OBTAINED, 1920 TO 1927

Condition	Cases
Exophthalmic goiter	1059
Toxic adenoma	545
Non-toxic adenoma	473
Colloid goiter	188
Nervous exhaustion, neurasthenia, and neurosis	133
Iodine hyperthyroidism	114
Hypothyroidism	86
Obesity	52
Myxedema	37
Miscellaneous	36
Multiple adenoma	35
Chronic tonsillitis	30
Menopause	28
General debility	25
Achylia gastrica	23
Hypertension	22
Pregnancy	19
Endocervicitis	14
Postinfluenzal debility	12
Froelich's syndrome	11
Tachycardia	10
Eczema	9
Dental sepsis	9
Myasthenia	8
Myocarditis	7
Cretinism	6
Chronic constipation	6
Chronic urethritis	6
Anemia	6
Psychasthenia	6
Amenorrhea	6
Nasal obstruction	5
Chronic cholecystitis	5
Chronic arthritis	5
Carcinoma of the thyroid	5
Lues	3
Mitral stenosis	3
Tetany	13
Acute tubular nephritis	2
Endocarditis	2
Proctitis	2
Epilepsy	2
Pulmonary tuberculosis	2
Headache	2
Arteriosclerosis	1
Exhaustion from work	1
Myalgia	1

metabolic laboratory. It is not the purpose of this paper to discuss the result of these tests in diseases other than goiter. It is sufficient to say that except in the case of myxedema, little significance is attached to the reports except for the purpose of eliminating hyperthyroidism. It is of interest to know what the metabolic rate is in case of pregnancy, anemia, cancer, gastric achylia and various other conditions, but the result of the test does not greatly alter the judgment of clinicians.

The averages in our laboratory for the various forms of goiter before and after treatment are reported in Table II.

TABLE II

AVERAGE METABOLIC RATE IN VARIOUS FORMS OF GOITER BEFORE AND AFTER TREATMENT

Type	Cases	Basal Metabolic Rate		
		On Admission, Per Cent	After Administration of Lugol's Solution, Per Cent	After Operation, Per Cent
Exophthalmic goiter	1059	+57	+37	+6
Toxic adenoma	545	+32	....	+4
Non-toxic adenoma	513	+ 6	....	+2
Colloid goiter	188	+ 3	....	
Iodine hyperthyroidism	114	+35	....	+4

CONCLUSIONS

1. The basal metabolic rate may furnish valuable information to the surgeon providing the test is made by a reliable machine, an accurate technician, and under the proper conditions.

2. Before attempting to interpret the results of metabolic studies the surgeon should be thoroughly versed in clinical studies of thyroid disease.

3. In exophthalmic goiter the metabolic rate gives valuable data regarding the result of the preoperative treatment, likewise regarding the result of operation, and the prognosis.

4. The metabolic rate is not an index of the risk of operability in toxic adenoma, but it does give diagnostic evidence of the presence or absence of hyperthyroidism.

OPEN REDUCTION

A REPORT OF 122 CASES

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OPEN reduction or operative treatment of fractures is both praised and condemned by men of the medical profession. In this report of 122 cases (tabulation), we shall endeavor to show why we have praised rather than condemned this type of treatment.

The procedure of closed reduction in doubtful cases has little in its favor except that there is less danger of infection. Results are not so satisfactory as in the open reduction, the healing time is increased, and adjustment of splints and braces must be made more frequently. The time spent in doing the reduction may or may not be shorter.

Open reduction allows absolute approximation of fragments, shortens the healing period, allows earlier manipulation and motion, a greater percentage of anatomical positions and better functional results.

Open reductions are almost universally satisfactory in the hands of surgeons who are familiar with the technique, and who have at their disposal proper instruments and other facilities necessary for this procedure.[1,2,3,4,5,6] The surgeons who condemn the open reduction are usually those who have not tried it, or those who have tried it, but, because of faulty technique, have met with complications that should have been avoided. This procedure cannot be carried out as simply as the closed reduction, but there should be no fear of untoward results if the surgeon has trained assistants, the necessary instruments, and above all, a knowledge of the technique.

The technique, which at first appears complicated, is quite simple in actual practice and can be carried out by any good operating-room staff. Infection is the bugbear which is most to be feared

and this is eliminated to a great extent when proper technique is employed. Few, if any, cases with infection end fatally if adequate drainage is established and the Carrel-Dakin treatment instituted. The infection will clear up and union will result without any permanent disability, but there will be a larger scar on the skin.

We use various means of fixation of the fragments in our cases of reduction; these include Sherman plates and self-tapping screws, nails, bolts, phosphobronze wire, Martin-Parham bands, staples, kangaroo-tendon, and chromicized catgut. We do not use bone screws, bone plates and ivory inlays in our own cases, but they are used successfully by some.

When a closed reduction insures good approximation and the possibility of satisfactory function the open operation is not considered. In our opinion, open reduction is indicated when a closed reduction will give less than 60 per cent approximation in the weight-bearing bones, and when deformity and loss of function can be diminished. In this connection the roentgenogram is a valuable aid in diagnosis, but it is not regarded without considering clinical findings as well. Open reduction is also the method of choice in case of compound fracture with extensive laceration and poor approximation of fragments. In these cases, however, the wound is left open and Dakin's solution applied for as long a time as is necessary to get union. When union has taken place the plate is removed and the wound allowed to close.

In the past fifteen years in this Clinic, 122 patients with fracture were treated by the open method. There was infection in the case of three of these patients, two of whom died. They were among the first of

the series; the third patient was treated about six years ago. Since that time there has been no case of infection. In the first of these 3 cases the patient infected the wound with feces; the second case was that of a cachectic patient who was in poor condition. In the third case the infection was due to contamination of instruments and was the only one of the three that was treated by the Dakin-Carrel method. In

site of operation is thoroughly cleaned by using alcohol and ether and applying a 3 per cent solution of iodine or a 5 per cent alcoholic solution of picric acid. This renders the skin less septic although it is far from sterile.

The incision is made over the site of fracture. This should be sufficiently long to facilitate handling of instruments and to avoid the necessity of enlarging the incision
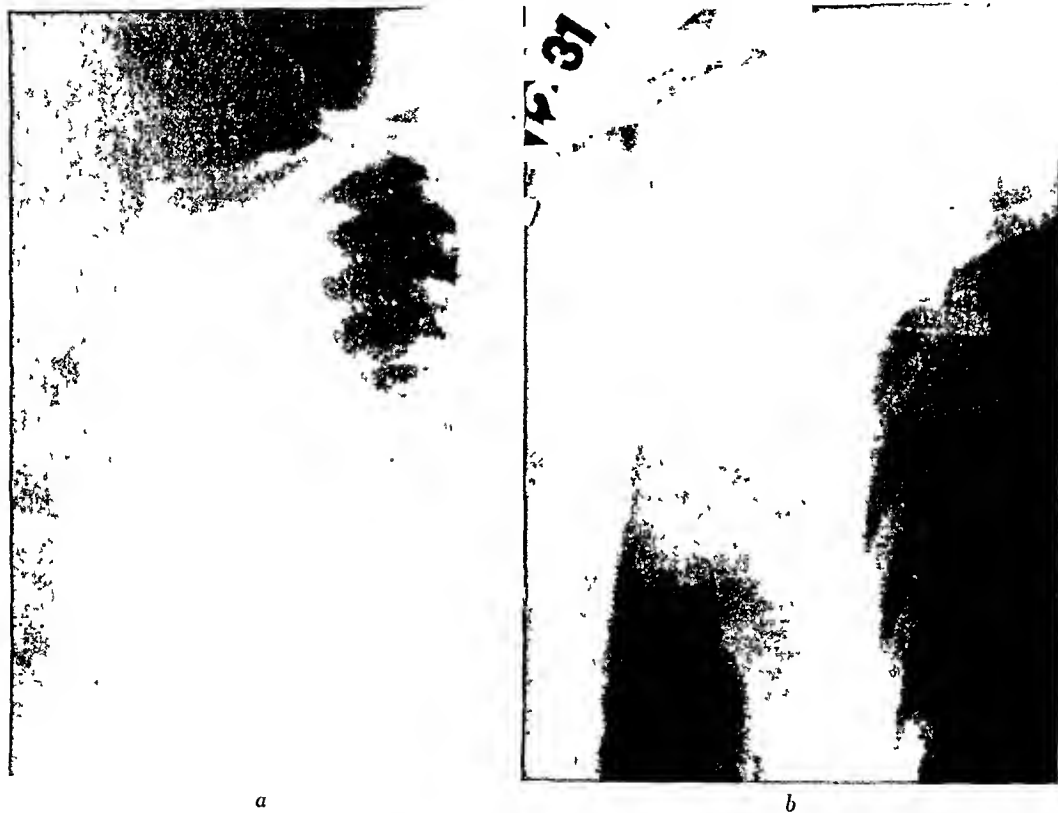
FIG. 1. Fracture of clavicle: a, before reduction; b, after reduction.

this case there was rapid convalescence, with perfect union and function.

We feel that in most cases of open reduction the period of recovery is shortened to about two-thirds as compared with the closed method; in some it is reduced even more. This factor is of sufficient economic importance to demand serious attention in industrial and insurance cases as well as in private cases.

TECHNIQUE

To prepare the patient, the skin at the

later. Bleeding vessels are ligated and the skin margins are covered with towels held in place by Bacchus or Moynihan towel clips. In some instances Michael wound clips may be used to advantage, but in our experience the Moynihan clamp has been the most satisfactory. These are placed at intervals of not more than 1 inch. The complete block of all skin margins is essential. Whenever possible, the scalpel should be plunged to the bone and the muscles divided from within outward, although this is not practical in all

approaches. The cut muscles are separated by retractors to permit a view of the bone ends. The bone ends are freed from muscle with a periosteal elevator. The bones are grasped near the site of fracture with Lane clamps; Berg clamps are substituted when a Berg extension clamp is to be used. The bone ends are freed from blood clots and muscle fragments by curettage, and enough extension is applied to overcome

plate is then applied and held in place while holes are drilled into the bone with a No. 32 Brown and Sharp drill. One or more screws in each fragment should pass through both cortices of the fragment. The Sherman self-tapping transfixion screws of the right length are then driven into the holes to hold the plate. Calipers are used to determine the diameter of the bone, so that the screws for transfixion may be of suffi-

FIG. 2. Fracture of right humerus in middle third: a, before reduction; b, after reduction.

any overriding. This is easily accomplished when the Berg clamp is used. The Berg clamp maintains its reduction as long as it is applied. When the overriding is reduced without the Berg clamp, it may be done by bringing both bone ends out of the wound, approximating the fractured ends and then returning the bone to the normal position. Once a reduction has been accomplished, it should be maintained by some suitable clamp such as the Lane clamp. A Sherman

cient length to hold in both cortices and not extend beyond into soft tissue. After all the screws have been driven in firmly, the clamp maintaining the reduction should be removed and the incision closed with as little catgut as possible. The skin is closed with Michael wound clips or with silk. A dressing is applied and also a supporting splint, cast, or whatever is indicated in the individual case. Early mobilization of the joints is advisable in these cases and mas-

sage and passive manipulation is instituted within ten days.

It is imperative that the surgeon, in doing this type of work, should have a complete armamentarium and a sufficient number of assistants. The rigid Lane technique which is essential may be a point

FIG. 3a. [Fracture of both condyles of left humerus: before reduction.

of trouble for some surgeons. It may be simplified if the surgical nurse hands instruments from her table to the surgeon with forceps. When the surgeon has finished with an instrument he drops it into a basin

containing hychlorite or sterile water. The second nurse removes it from the basin and washes it in sterile water if it is taken from hychlorite, or sterilizes it in alcohol if it is removed from water, and returns it to the instrument table. The entire procedure is carried out by the use of forceps, the surgeon being the only one to touch the instruments with gloved hands.

In fracture of the tibia or clavicle, or in any compound fractures, the plates are removed routinely. In all other cases they are left in place. In one of our cases (Case 6) a roentgenogram, taken ten years after the open reduction, shows the nails still in place.

SELECTION OF CASES

Until recently the general surgeon and general practitioner have been concerned more with union than with functional results. If in a case of fracture of the femur the patient could walk, even though he limped and had pain, the result was considered good. Since cases of industrial injury and automobile accidents have become more numerous, this is not a satisfactory functional result. We must consider whether or not the patient can resume his former occupation with sufficient function to perform his work without distress or pain. If the patient limps and has pain he does not consider himself functionally normal, even though union may be solid and approximation fair.

Corrective measures must be taken in the first week or ten days by either the closed or open method. If the closed method is unsatisfactory during the first week there is still ample time for the open method. To wait for from six weeks to six months complicates matters, because during that period some damage may have been done that cannot be corrected.

It is our practice in the case of simple fracture to consider the closed reduction first. When this is not satisfactory we wait for from eight to ten days from the time of the fracture before doing open reduction. This allows time for swelling to decrease,

blood clots to be absorbed, and small vessels to heal that may have been traumatized at the time of the fracture. At the end of ten days the tissues have developed more resistance, and if extension has been carried on during this period, reduction is more easily accomplished and the tissues are in

cessful treatment of fracture. Acknowledgment is made to him for his willingness in aiding us to gain more experience in this method of treatment, for improvement in our technique, and for suggestions regarding postoperative treatment.

We are reporting here 9 cases from our
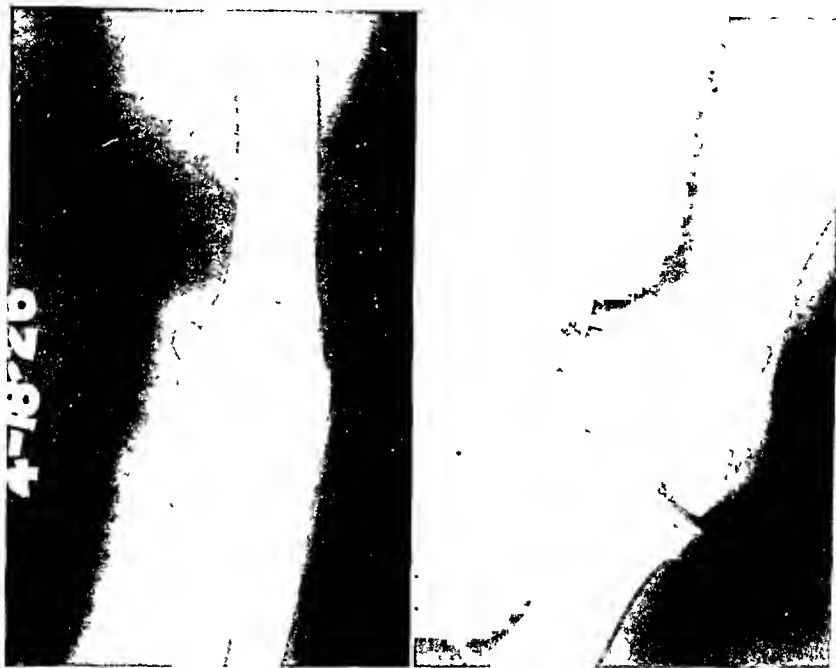
FIG. 3b. Fracture of both condyles of left humerus: after reduction.

much better condition to combat possible infection.

COMMENT

Sherman,[4] in more than 1500 cases of open reduction, found infection no more prevalent than in any elective operation. He repeatedly emphasizes the necessity of correct technique. He considers the laparotomy technique of the general surgeon not only insufficient but dangerous. Gloved hands should never come in contact with the skin or be introduced into the incision. Proper instruments will suffice for the necessary steps and lessen the danger of contamination. He further maintains that open reduction is contraindicated except when the armamentarium and operative technique are available.

Sherman has probably done more than any other one man to promote the suc-

series which represent the more common fractures that have been treated by the operative method. These are the more typical cases in which open reduction is easily done by the general surgeon with proper armamentarium and technique. In the treatment of these cases plates, bolts and nails were used.

Our series is small, but coming from a non-industrial locality it is of some value, we trust, in showing the advantage of the open reduction when facilities permit.

REPORT OF CASES

CASE I. A woman, aged thirty-six, sustained a fracture of the clavicle on December 25, 1926, in an automobile accident. On December 28, after three unsuccessful attempts at reduction, open reduction was done and a four-screw Sherman plate applied. Convalescence was uneventful. On January 6, 1927, the patient left the hospital, and returned on

FIG. 4. Oblique fracture of upper end of ulna including olecranon from shaft of left ulna: *a*, before reduction; *b*, after reduction.
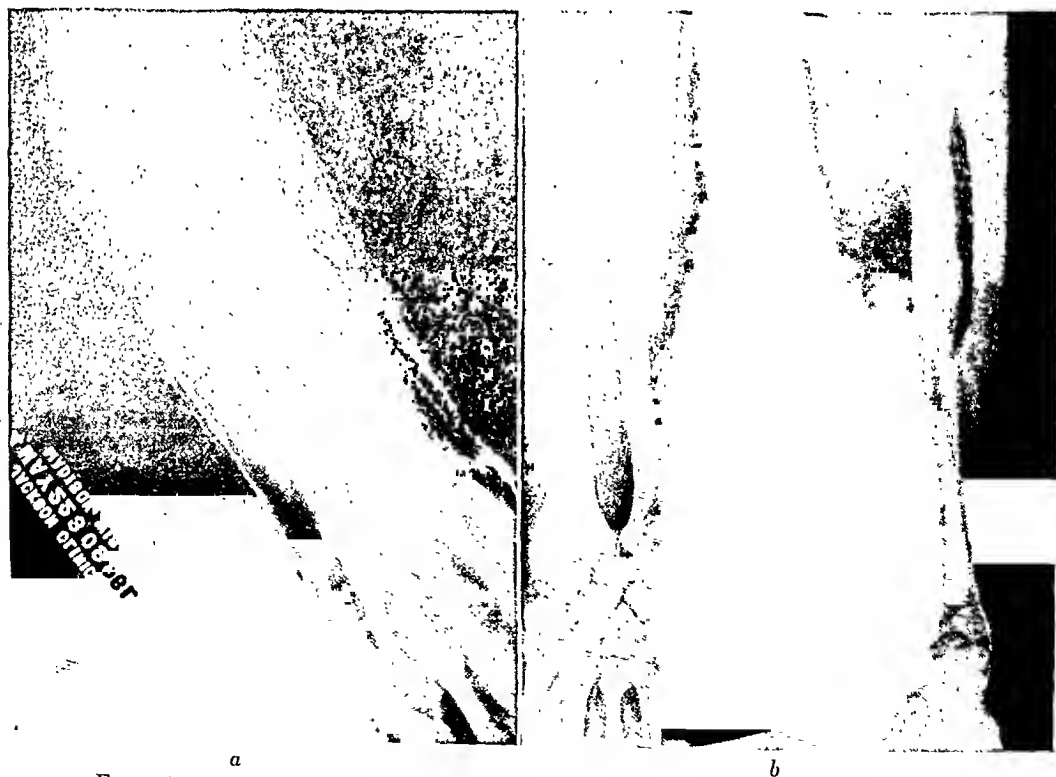
FIG. 5. Fracture of both bones of left forearm: *a*, before reduction; *b*, after reduction.

March 9 for removal of the plate. On March 14, when she was dismissed from observation, function and position were normal (Fig. 1).

The patient left the hospital on January 17, 1924, to continue physiotherapy at the Clinic. When she was dismissed from observation

FIG. 6. Fracture of neck of left femur: *a*, before reduction; *b*, after reduction.

CASE II. This patient fell on December 21, 1923, and broke the right humerus in the middle third. Her local physician tried to reduce the fracture but was unable to maintain reduc-

on February 8, function and position were perfect (Fig. 2).

CASE III. A boy, aged seventeen, fell on February 18, 1919, and struck the left elbow.

FIG. 7. Fracture of middle third of right femur. *a*, before reduction, *b*, after reduction.

tion. After three unsuccessful attempts she was brought to the Clinic; and on December 31 open reduction was done with a six-screw Sherman plate. Convalescence was uneventful.

Both condyles of the left humerus were fractured. On February 22 open reduction was done. One bolt was passed through both condyles of the left humerus. Convalescence was
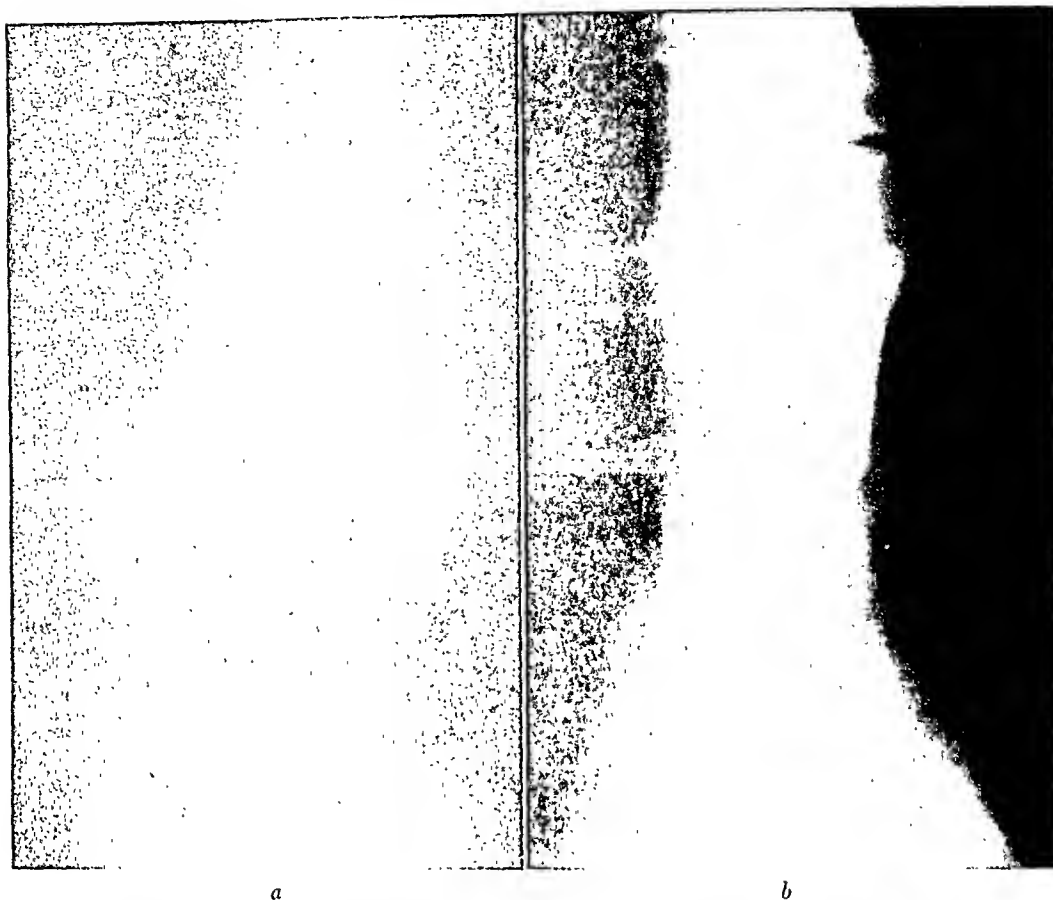
FIG. 8. Fracture of lower third of right femur: *a*, before reduction; *b*, after reduction.

FIG. 9. Transverse fracture of left patella: *a*, before reduction; *b*, after reduction.

uneventful. On March 5 he left the hospital and came to the Clinic for physiotherapy, and on April 7 he was dismissed from observation with normal function and position (Fig. 3).

CASE IV. A man, aged thirty, was injured in a motorcyle accident on April 16, 1927. He sustained oblique fracture of the upper end of the ulna, including the olecranon, from the shaft of the left ulna. It was impossible to maintain approximation of the fragments because of swelling and interposed tissue. On April 26 open reduction was done; one Sherman screw was transfixed through the fragment to the shaft. Convalescence was uneventful. On May 6 the patient left the hospital and came to the Clinic for physiotherapy. He was dismissed with normal function and position (Fig. 4).

CASE V. A woman, aged twenty-seven, fell down stairs on May 4, 1922, and fractured both bones of the left forearm. Because of swelling, position could not be maintained. On May 17 open reduction was done and a four-screw Sherman plate applied to the radius; the region of the ulna was not opened. Convalescence was uneventful. On June 7 the patient left the hospital and came to the Clinic for physiotherapy. When she was dismissed from observation on July 26 there was good function and position of the radius, and fair position of the ulna (Fig. 5).

CASE VI. A woman, aged seventy-one, fell on the ice on February 6, 1916, and injured the left hip and fractured the neck of the left femur. Open reduction was done on February 14; the neck of the femur was nailed through the greater trochanter to the head of the femur. Convalescence was uneventful. She left the hospital on June 8, walking; function was normal and there was no shortening (Fig. 6).

CASE VII. A boy, aged eight, in an automobile accident on September 4, 1924, fractured the middle third of the right femur. Open reduction was done on September 18, and a four-screw Sherman plate applied. Convalescence was uneventful. He left the hospital on October 3 and came to the Clinic for physiotherapy. By November 13 he was dismissed from observation with normal function and position (Fig. 7).

CASE VIII. A girl, aged eleven, was struck by an automobile on July 23, 1924, and fractured the lower third of the right femur. Two attempts at reduction under the fluoroscope were unsuccessful. Open reduction was done on August 7, and a six-screw Sherman plate was applied. Convalescence was uneventful. The patient left the hospital on September 17, to continue physiotherapy at the Clinic. She was dismissed from observation on December 10 with normal function and position (Fig. 8).

CASE IX. A man, aged fifty-five, fell on April 12, 1923, while crossing a railroad track and struck his left knee on the rail. He sustained transverse fracture of the left patella. Open reduction was done on April 14, and the patella was sutured. Convalescence was uneventful. He left the hospital on June 27 and came to the Clinic for physiotherapy. He was dismissed from observation on July 10 with good position and 95 per cent function; there was about 5 per cent limitation in extension (Fig. 9).

CONCLUSIONS

From the results of our series of cases of open reduction it may be concluded that:

1. The open reduction with proper armamentarium and technique is no more dangerous than ordinary laparotomy.

2. It is less painful.

3. There is more certainty of the patient's returning to his former occupation.

4. The patient returns to his work sooner than when the closed method is used.

5. There is less likelihood of the development of extensive callus, pain, and disability.

CASES SELECTED FOR TREATMENT

Bone	Fractures			
	Upper Third	Middle Third	Lower Third	Total
Humerus	4	12	10	26
Radius	0	2	3	5
Radius and ulna	0	10	6	16
Ulna	8	3	0	11
Femur	3	16	7	26
Tibia	0	2	3	5
Tibia and fibula	0	4	12	16
Clavicle				10
Patella				7
Total.	—	—	—	122

6. It is easier to obtain correct approximation, better weight-bearing, and function.

7. Open reduction is favorable to early manipulation and motion.

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DIAPHRAGMATIC HERNIA
REPORT OF THREE CASES

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A REVIEW of the literature on diaphragmatic hernia prior to 1920 gives the impression that the presence of abdominal viscera in the thorax is relatively infrequent. Giffin found that 650 cases had been reported previous to 1912; most of these were discovered at necropsy, a few were revealed during exploratory laparotomy, and in a small percentage clinical diagnosis was made during life. Fifty-seven cases were reported in the literature from 1912 to 1920, most of which were revealed at necropsy.

Since 1920, however, interest in diaphragmatic hernia has increased and about 1000 cases have been diagnosed and reported. An increasing percentage of diagnoses is being made during life. The literature in 1923 and 1924 became so voluminous that today in making a screen examination of the chest or gastrointestinal tract this once supposedly rare condition is routinely looked for. No longer are isolated cases reported as rare and interesting, but rather discussions of treatment and brief records of clinical observations form the bulk of the material on the subject. Diaphragmatic hernia, however, is of unusual occurrence; Carman, in his report of 17 cases, estimated the frequency as 1 in 18,000.

Recognition of diaphragmatic hernia will be more frequent if there is cooperation between the clinician and the roentgenologist, since the symptoms, when present at all, are usually vague and indeterminate. In a review of the available reports of cases it was found that a diagnosis was made roentgenologically in about 90 per cent of cases reported since 1912. If it is remembered that diaphragmatic hernia may roentgenologically simulate pneumothorax, hydrothorax, lung abscess, bronchiectasis, eventration of the diaphragm or diverticulum of the esophagus, confusion in diagnosis will be greatly reduced. Another difficulty, both clinically and roentgenologically, is that hernia is sometimes intermittently recurrent, especially the congenital type, and may not appear at the time of examination. If the hernial sac contains only solid viscera, the diagnosis is increasingly difficult.

Hernia of the diaphragm is classified as congenital and acquired, true and false. True congenital hernia is the most common. The herniated viscus, according to several writers, may be any or all of the organs in the abdominal cavity. Mayes reported the case of a child whose thorax contained the omentum, stomach, spleen, pancreas, left kidney, colon and part of the duodenum, jejunum, and ileum. There was also dextrocardia. Similar to Mayes's case is one reported by Hess. The abdominal organs usually found protruding through the diaphragmatic opening are, in the order of their frequency, the stomach, colon, omentum, small intestine and spleen.

Diaphragmatic hernia may be the result of congenital enlargement of normal openings in the diaphragm, trauma, short esophagus, or final rupture of an eventrated diaphragm. Congenital deficiency of the diaphragm occurs most commonly on the left side. In one case diagnosed at necropsy there was no diaphragm on the left side, and in another the diaphragm was not united to the posterior wall on the left side.

The symptoms in the clinical history which were most common in the cases reviewed are referable to the chest: distress,

gurgling, precardial pain, and dyspnea. In a large group of patients there are also the symptoms referable to the gastro-intestinal tract: pain, distress, burning or fullness in the upper portion of the abdomen, nausea and vomiting after meals with relief from distress, flatus and eructation, pyrosis, mild dyspepsia and weak stomach. Other suggestive symptoms are abdominal cramps with constipation, difficulty in

FIG. 1. Semischematic oblique view of stomach as seen on the screen: *a*, left portion of diaphragm; *b*, proximal third of stomach in thorax; *c*, esophagus.

swallowing food, and a cough which is usually non-productive. Hematemesis has also been reported as a symptom. The common physical findings are referable to the chest: gurgling or splashing, usually on the left side; tympany or dullness, depending on whether or not the herniated organ is solid; distant breath sounds over part of the chest; diminished expansion and difficulty in percussing the heart. Absence of Litten's sign is frequently mentioned in the literature.

Treatment is entirely surgical. Although the operative mortality is high (33.5 per cent, according to Hedblom), the probability of fatal complications in uncorrected hernia justifies surgical interference.

REPORT OF CASES

CASE I. A man, aged fifty-four, came to the Jackson Clinic on January 16, 1924, complaining of gas and burning in the stomach with considerable distress, mainly in the epi-

gastrium and left hypochondrium, with onset two or three hours after eating. These attacks at times had occurred during the night, and had become more severe during the past month or two. Constipation was marked.

In 1896 the patient had had typhoid fever, and in 1919 influenza. He complained of having had a little stomach trouble for ten years; occasionally during this time he had had epigastric distress in the daytime without relation to meals, and a bad taste in the mouth when he arose in the morning, sometimes with belching of sour gastric content. Four years previously he had been confined to bed with an attack of intense pain, most severe in the left hypochondrium, accompanied by marked jaundice. At that time a diagnosis of cholecystitis had been made. The attack had subsided in about two weeks.

Physical examination revealed nothing of importance. The patient's height was 5 feet 10 inches, and his weight normal, 170 pounds. The systolic blood pressure was 158 and the diastolic 100; the pulse rate and temperature were normal. Occult blood was found on gastroanalysis and the patient was referred for roentgenologic study.

By vertical screen inspection of the thorax and abdomen the diaphragm and other visible structures were identified, but nothing suggestive of a lesion was noted. When the barium emulsion began to pass down the esophagus, its shadow was seen to form in considerable size above the diaphragm and was superimposed on the silhouette of the heart. A brilliant area, like a gas bubble, appeared above the level of the accumulated barium mixture. At first sight this suggested marked dilatation of the esophagus. The meal passed slowly below the diaphragm, revealing a normal outline of the distal half of the stomach; alternate dark and light vertical shadows were interpreted as gastric rugae in the field above the diaphragm from which the accumulated barium was passing. The patient was rotated to the oblique position and additional barium mixture was given. The esophagus was then seen to be somewhat tortuous, not dilated, and to empty immediately above the diaphragm into the gas-filled area already mentioned (Fig. 1). With the patient in this position, the opaque area above the diaphragm was observed to communicate with the shadow of the stomach below by a constricted channel about 6 cm. in diameter. In a short time the stomach became more dependent and was

dentified below the diaphragm. Horizontal, dorsoventral screen examination showed the stomach in normal relation. The patient was then rotated to the back, and the shadow began to reappear above the diaphragm. After some manipulation, much of the stomach was pushed into the thorax through what appeared to be a large circular opening. A normal duodenal cap was visualized, and subsequent examination revealed that the colon and other recognizable abdominal viscera were normal. Diagnosis was made of intermittent hernia of part of the stomach into the thorax through an enlarged opening in the diaphragm at the site of the esophageal ring.

After roentgenologic examination, the personal history and results of physical examination were again carefully reviewed with the aim of obtaining a history of diaphragmatic hernia. It was learned that in 1919 the patient fell to the ground from a scaffold 14 feet high, and landed on the head and shoulder. He was dazed, but no injury was noted, and no particular attention was paid to the fall. Soon after this accident a gurgling sound was noticed in the lower portion of the chest with some pain and fullness, principally on the left. It was after the fall that the attacks of nausea with occasional vomiting began. It was noted further that assuming various positions in bed gave distress, the greatest comfort being afforded when the patient lay on the left side. Also, when he turned over in bed the intestines moved about in the abdomen in such a way that some relief was obtained.

Careful percussion of the abdomen and thorax elicited no unusual tympany, but auscultation disclosed gurgling over an area above and to the left of the ensisternum when the patient was rotated from side to side, and when upward pressure was applied to the left hypochondrium.

CASE II. A feeble man, aged seventy-nine, came to the Clinic on April 7, 1926, complaining of nausea and vomiting accompanied by cramp-like pains in the abdomen. This nausea and vomiting had come in spells every two or three months for a great many years, sometimes lasting six or seven days. During the attack he was unable to retain for more than a few minutes anything that he ate or drank. The patient had never vomited any blood. He complained of chronic constipation all his life which was relieved only by purgatives. He had been bothered considerably by asthma and had a chronic non-productive cough. During these attacks the asthma and the accompanying cough became worse, and he would lose from 10 to 18 pounds, but would regain most of it before another attack. During the month preceding examination he had lost 18 pounds. I saw him in remission, during which time he had regained about 8 pounds. During the remission he was physically well but was suffering some depression occasioned by dread that another attack might come on at any time.

Physical examination, gastroanalysis, urinalysis and blood test revealed nothing abnormal, and the Wassermann reaction was negative.

The patient was referred to the roentgenologic department for examination of the stomach. Fluoroscopic survey of the chest revealed a peculiarly brilliant limited area at the right base that could scarcely have been taken for anything but a loop of abdominal viscera. Barium was administered orally and the stomach was seen to fill without event. Its lumen and that of the duodenum were found to be normal and had no relation to the luminous area at the right base previously noted. The patient was seen again in six hours when the head of the meal was approaching the cecum, the major part being in the distal loop of the ileum. In a twenty-four-hour fluoroscopic observation the barium mixture was found scattered throughout the colon except for a segment of the hepatic flexure and the proximal transverse colon. At this time purgatives were administered and the patient was directed to return in two days for a study of the colon by clysma.

On introduction of the clysma the colon filled without event until the clysma approached the hepatic flexure; then the patient complained of cramp-like pains, nausea, vomiting and dizziness. The barium mixture after a few moments' hesitation was seen to pass above the diaphragm (Fig. 2), then downward again, filling the remaining portion of the colon. But during the last part of the procedure the patient was overcome by a fit of coughing which made it impossible for him to cooperate further in the examination.

We are able to conclude fairly accurately that the frequent attacks of gastrointestinal turmoil

were occasioned by intermittent herniation of a loop of the colon, apparently the hepatic flexure, into the thorax. It was not possible to determine by what route this viscus had passed above the diaphragm, nor were we able to learn whether or not the condition was congenital or acquired. However, we are of the opinion that it was congenital, although the early history of the complaint is rather vague in the mind of the patient.

The conclusions of the internist are quoted

which overturned, pinning him under it. When the patient arrived at the hospital he was paralyzed from the hips down and was in considerable shock. The condition of shock was overcome by intravenous administration of glucose and insulin, and his general condition appeared good. Except for bruises on the back and thighs, and paralysis of the lower extremities, physical examination revealed nothing of importance.

Roentgenologic examination revealed a com-

FIG. 2. Hepatic flexure of colon seen at right base above diaphragm.

FIG. 3. Upper half of stomach shown at left base above the diaphragm.

from the chart: "If he were a younger man we would advise an exploration, but in view of his age and the fact that the attacks come but a few times a year we feel that it would be advisable for him to get along the best way he can and put up with the attacks whenever they occur. I see no way of avoiding these attacks, as the cause is purely mechanical."

CASE III. A man, aged thirty-five, brought to the hospital on October 23, 1925, was in a semiconscious condition. Two hours previously he had been driving a Ford truck on the highway at a high rate of speed when he hit loose gravel and lost control of the car,

minuted fracture of the 1st lumbar vertebra with conspicuous displacement of fragments; fractures of the left transverse processes of the 1st, 2nd, 3rd, and 4th lumbar vertebrae, and fractures of the 7th, 8th, and 9th ribs on the left side without displacement of fragments. At the left base of the thorax there appeared an oblong gas-filled area, 7 by 12 cm., the upper level of which was at the seventh interspace posteriorly, extending downward and communicating through the diaphragm, with a corresponding shadow in the abdomen in the approximate location of the stomach (Fig. 3). This was interpreted as being a part of the stomach in the left base of the thoracic cavity. Under local anesthesia and gas, decompression

was performed on the cord at the level of the 1st lumbar vertebra; during this operation the patient's condition remained good. About twenty minutes after the completion of the decompression the patient again went into shock and died soon thereafter.

Permission for necropsy was granted but was withdrawn before much had been accomplished. It was found, however, through abdominal approach, that there was a rent in the posterior aspect of the left portion of the diaphragm through which had passed a large portion of the stomach.

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MULTIPLE ADENOMA OF THE THYROID WITH GLYCOSURIA

REPORT OF A CASE

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THE importance of coordination between medical and surgical management is well recognized in a case presenting several conditions which require and are amenable to treatment. I wish to report a case in which glycosuria in the presence of mildly toxic goiter disappeared on removal of the goiter and return of the metabolic rate to normal. The hypertension, with high pulse pressure, the edema noted on admission, the marked tonsillar sepsis, as well as the evidence of cholecystic disease, are also notable features of the case.

REPORT OF CASE

A woman, aged fifty-three, was first seen in the Clinic on June 15, 1927. The past history was uneventful, except for yearly attacks of tonsillitis, and an attack of acute arthritis in the right knee four years previously. Her chief complaints were shortness of breath, weakness, and loss of weight (from 220 to 188 pounds in a year's time). Six weeks before admission she had had an attack of acute bronchitis; dyspnea with irregular heart action had been noted for about two weeks, and for a few days only she had noted swelling of the limbs. Glycosuria had been noted by the family physician three or four weeks previously and he had instituted qualitative carbohydrate restriction.

On examination the patient appeared rather obese; the ankles were moderately edematous. The systolic blood pressure was 160, the diastolic 58, and the pulse rate was 116, notably irregular. The thyroid gland was irregular in shape, firm in consistency, and quite prominent. There was moderate hypertrophy of the heart. The tonsils were large and septic and there was fairly definite tenderness over the region of the gall bladder.

Urinalysis revealed sugar, Grade 3, specific gravity 1.029, no albumin or acetone. The blood sugar was 165 mg. for each 100 c.c. of blood. Hemoglobin was 80 per cent; the erythrocytes numbered 5,460,000, and the leucocytes 8000. The patient went to the hospital at once for management of the glycosuria and regulation of the heart's action. During the preoperative period the average systolic blood pressure was about 170 and the diastolic 74. A summary of the trend of the glycosuria during the period of observation is given in the accompanying table.

On June 24, tonsillectomy was performed by Dr. Barlow. By June 30, the basal metabolic rate was plus 27 per cent, and the patients' weight was 170 pounds. At this time she was allowed to return home on a maintenance diet of diabetic type and 6 units of insulin twice daily was prescribed. On July 13, when she returned, no sugar was noted, but the systolic blood pressure persisted at 180 and the diastolic at 86. The period at home was uneventful save for a one-day attack of colicky pain in the region of the gall bladder.

Thyroidectomy on July 18 was performed by Dr. Arnold S. Jackson. Postoperatively insulin was given and only traces of acetone in the urine appeared, although for several days considerable amounts of glucose appeared in the urine, the maximal amount being 51 gm. in one twenty-four-hour specimen, and the next highest 29 gm. During the immediate postoperative period she was routinely given 6 units of insulin twice daily in addition to 200 c.c. orange juice, 20 gm. glucose, and 20 units of insulin together, several times when it seemed indicated. On July 20 the temperature rose suddenly to 104°F. with signs of consolidation at the bases of the lungs; however, by July 23 the temperature had returned to normal and the signs had cleared. Convalescence then continued without event. By the end of July the systolic blood pressure

TREND OF GLYCOSURIA IN PATIENT WITH HYPERTHYROIDISM

Date, 1927	Pulse rate	Blood pressure Systolic	Blood pressure Diastolic	Weight, pounds	Basal metabolic rate	Temperature, degrees F	Diet Carbohydrates, gm	Diet Proteins, gm	Diet Fats, gm	Diet Calories	Glucose available, gm	Insulin, units	Natural tolerance	Blood sugar, per cent	Glucose in urine, gm	Acetone	Remarks
6/15	116	160	58	188										0 165	Grade 3	−	
6/18							100	50	100	1,500	139				12	−	
6/21	80	170	74				100	50	100	1,500		6 twice daily			11	+	
6/24																	Tonsillectomy
6/25	92	180	80				78	50	120	1,592							
6/28												6 twice daily			6	+	
6/30				170	+27 per cent												
7/15	72	154	64				90	50	120	1,640	131						
7/16												6 twice daily		0 160	Trace	Trace	
7/18												12				Trace	Thyroidectomy
7/19							80 liquids	12	10	458	88				29		
7/20						104 6	80 soft, liquid	19	46	810	103	18 in 3 doses	16		51		Extra-endogenous metabolism
7/21							168	33	93	1,641	182	58 divided	46		24	−	Pneumonia
7/24						99 4	102	37	87	1,339	131	12	95		12	Slight trace	
7/25							122	40	110	1,638	156	16 in 2 doses	116		8	Slight trace	
7/30	84	140	76				100	50	125	1,725	141	20 in 2 doses	101		−	−	
8/9	80	150	80				100	50	125	1,725		18 in 2 doses			−	−	
8/10												18 at home					Dismissed from hospital
8/11				159	+3 per cent									0 11	−		
8/25												2 at home					
9/9												2 at home			−	−	
9/21							Qualitative carbohydrate restriction								−	−	

was 140, the diastolic 76, and the general appearance of the patient was much improved. No glycosuria was noted during the remainder of her stay in the hospital, which terminated on August 9 although she was still receiving two 6-unit doses of insulin daily at this time.

By August 11 the basal metabolic rate was plus 3 per cent and the weight 159 pounds. On August 25 she returned to the Clinic and a twenty-four-hour specimen of urine was sugar free. She was, therefore, permitted to return home on qualitative carbohydrate restriction only and no insulin. On September 6 and again September 21 the twenty-four-hour specimens of urine were sugar free; the systolic blood pressure was 150 and the diastolic 80, and the general sense of well-being good.

The association of glycosuria with hyperthyroidism is, of course, not new, and the work of such men as Fitz, Joslin, and Wilder is of special interest in this connection. Fitz reported a number of cases of diabetes combined with non-toxic goiter in which the goiter had no influence on the course of the diabetes, a conclusion confirmed by Wilder in a review of more than 50 additional cases. The rare incidence of diabetes combined with hyperthyroidism, compared to the incidence of either condition alone,[3] does not uphold the view that hyperthyroidism can initiate diabetes in a person not predisposed to it.

But there seems no doubt that hyperthyroidism can greatly aggravate an already existing diabetes. A number of facts seem to support this view: (1) Administration of thyroid extract has been known to provoke glycosuria (alimentary?) in supposedly normal persons, and when it is given in cases of frank diabetes the glycosuria is greatly aggravated. (2) When the intensity of the hyperthyroidism is reduced by the giving of iodine, the intensity of the glycosuria is greatly reduced. (3) Conversely, in periods of exacerbation of the hyperthyroidism in the combined cases, glycosuria is greatly increased. (4) Following thyroidectomy the glucose tolerance in such cases is greatly improved. (5) In the event of postoperative myxedema in such a case, the sugar tolerance may return practically to normal. These phenomena have been best explained[1,2,3] on the basis of variation in the metabolic rate. This explanation is in harmony with the fact that increase in the metabolic rate stimulated by high-protein feeding (explained in this case by the high specific dynamic action of protein), by fever or by pregnancy, produces decreased carbohydrate metabolism.

Certain facts regarding the relation of hyperthyroidism and diabetes have been emphasized by Joslin: (1) The increased metabolism of hyperthyroidism is just as harmful to patients with diabetes as overeating of food, and is more likely to lead to coma, since the endogenous overeating goes on day and night, whereas the exogenous overeating is confined to a few meals a day. (2) Surgery in the presence of hyperthyroidism and diabetes is necessarily attended with certain hazards, but if one adheres to procedures now well recognized he may expect to succeed. (This author cites a case in which, as can well be imagined, some seven specialists cooperated in a single day.) (3) There are certain similarities between hyperthyroidism and diabetes: each leads to overeating and in turn to emaciation; there is association in both of red cheeks with weakness, indicating a high protein destruction; if uncontrolled, the metabolism in each case runs too high; if over-controlled, as by the removal of too much thyroid or extreme undernutrition, the metabolism runs too low.

In the case reported it is presumed that the glycosuria was probably the result of true, though mild, diabetes, probably of arteriosclerotic origin, activated by the coexisting hyperthyroidism. That insulin is less efficient in the presence of a high metabolic rate is roughly illustrated in this case by the improvement of the natural tolerance with the subsidence of the fever and toxicity of the thyroid. Since during the first day or two postoperatively it was difficult to maintain an adequate caloric intake to meet the basal requirements, much of the glycosuria must have been of endogenous origin. The increased glucose tolerance postoperatively is therefore to be explained on the basis of reduction in the metabolic rate and increase in the efficiency of the patient's own natural insulin, rather than on the basis of any special improvement in the condition of the diabetes itself or of pancreatic function.

SUMMARY

A case is reported of a patient past middle life presenting arteriosclerosis and toxic goiter with associated cardiac insufficiency, tonsillar and gall-bladder sepsis, and glycosuria. On removal of the tonsils and thyroid her general condition was greatly improved, and the glycosuria disappeared, probably as a result of the decreased load on the patient's metabolism, with resulting greater efficiency in the natural supply of pancreatic hormone.

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A NEW BONE-HOLDING CLAMP

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A NEW bone-holding clamp has been devised, with the object of providing an instrument by which the two sections of a long bone may be accurately aligned and held in the properly aligned position until the plaster cast becomes hardened. The majority of bone clamps used heretofore have consisted of two separate clamping elements which were not

procedures may eventually be entirely eliminated.

Cases of true non-union of bone are comparatively rare, the most frequent being the intracapsular fracture of the femur. The lower third of the tibia is next in order of frequency. The principal cause of non-union in the latter type of fracture is lack of blood supply, whereas in the

FIG. I.
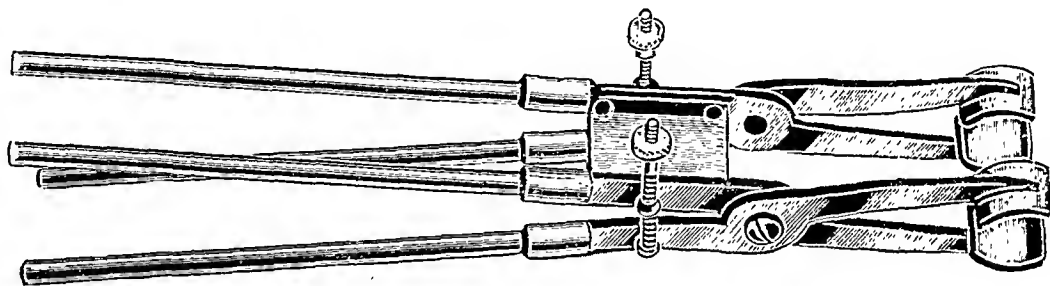
connected, and during the various means of applying retentive dressings, the ends of the bones would slip and overriding take place.

The method with this new clamp is particularly satisfactory in that the personal equation in the holding of the severed ends of bones together is largely eliminated, and replaced by a surer mechanical device. In the present instrument, two clamps are really made a part of a single appliance. They are individually adjustable to engage the two sections of bones to be aligned; but means is also provided for the accurate locking of the two clamps against any relative movement after they have been applied.

In Figure 1 is seen a drawing of the clamp as it is now being modified by the manufacturer. With the proper use of this bone clamp, I believe that bone grafting operations upon the long bones, wiring and plating, bone bands and other operative

intracapsular type, non-union occurs through faulty reduction or the interposition of muscle or fascia. Syphilis for years was given as the cause of non-union, but this condition can now be disregarded.

In fractures of the long bones, especially those of the lower extremity, I believe that if 25 per cent of the fractured surfaces is in apposition, a good functional result will ensue with the proper weight-bearing capacity. As we gain further experience and skill in the reduction of fractures by the open method, we aim more and more to simplify the operative procedure, and avoid leaving any foreign substance in the wound. The Parham and Martin bands have given excellent results in the past in oblique fractures, especially of the femur, but they present the difficulty of constricting the periosteum in its entirety, and the secondary removal is somewhat difficult.

The use of bone transplant has met with success, but I believe that the results

obtained were due to the open reduction, the clearing of debris from between the fractured ends of bone and the perfect approximation of bone fragments, rather than to any holding quality of the bone graft or its ability to proliferate new bone.

With the hope of eliminating all foreign substances remaining in the wound, I have devised this instrument for holding the ends in place while the plaster is being applied. The clamp itself consists of a body with projecting arms, removable handles, and a fixing or tightening apparatus to retain the clamp in place after the fragments are properly aligned. The arms are inserted along the posterior surface and the fixation nuts are screwed down, retaining the fragments in place. The handles can be removed by one turn clockwise and a projecting metal cover placed over the entire device, including the dressing. This cover varies in size and shape with the length of the incision. For the purpose I have used an empty $\frac{1}{2}$ lb. soda bicarbonate container. The plaster of Paris dressing is then applied to the entire limb, including the cover. When hardening of the cast occurs, the plaster is cut about the cover device, the handles reinserted in the clamp, and the clamp removed from the wound.

If this bone-holding clamp and method of procedure are properly used, I feel that simplification and improvement in the treatment of bone fractures will result.

HEAD TILTING AND TURNING OF OCULAR ORIGIN*

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HEAD tilting of ocular origin was first described, according to Bielschowsky, by Cuignet in 1871, and more fully described by Landolt in 1890. Since then much has been written and

one of the large number of cases observed was a true torticollis, with the contracted sternomastoid, associated with an ocular paralysis that would probably have caused the head to tilt in the same direction.

FIG. 1.

FIG. 2.

FIGS. 1 and 2. The head tilt most frequently seen, compensating a paralysis of the superior rectus muscle, either congenital or acquired; in both cases shown the origin is congenital.

many cases reported. Much that has been written has, from all appearances, been copied from previous works and is not the result of personal observations.

Whitman's textbook on Orthopedic Surgery describes ocular torticollis as an improper attitude of the head rather than a torticollis, and classes it with the acquired forms of torticollis. It is true that in only

Which element was the primary lesion we were never able to prove; but from the infrequency of this finding, we believe that they were two independent congenital anomalies or lesions acquired in early life.

The act of head tilting seems to be a combination of visual and neuromuscular impulses. There is every evidence that the desire for binocular single vision is a strong

impulse. There are many cases, however, where with one eye markedly amblyopic, or, in one case, without even light preception, the head tilt was the same as that resulting in binocular single vision. There seems here to be no other explanation but that of muscle sense.

From earliest childhood there is a strong aversion to any misalignment of the visual axes. This is seen in babies a few months

cases of nystagmus. Here the head is turned so as to put the eyes in the field of the slower component. The second condition is the head tilt not infrequently seen in uncorrected cases of high astigmatism. The tilting here seems to result in somewhat better vision.

The torticollis due to ocular muscle paralysis is the variety most frequently seen.

FIG. 3.

FIG. 4.

FIG. 3. Congenital paralysis of both the superior rectus and inferior oblique muscles of the right eye. The head is tilted back to enable use of the eyes in the lower field, where the patient has single binocular vision.

FIG. 4. Head tilt compensating a paralysis of the right superior oblique.

　　All of these cases were corrected by operative intervention, either wholly or nearly so; operative interference seems to give the most satisfactory results in the majority of all of these cases.

FIG. 5. Diplopia chart in a case of head tilting due to a paralysis of the left superior rectus. The head was turned so that the area of binocular single vision was used when looking straight ahead and slightly down.

old who keep one eye shut much of the time or who hold the eye shut with their fists. This condition of monoblepsia is quite frequently seen in adults as well as in infants.

There are two conditions causing head turning that should be mentioned in passing; the first is that present in some

Lateral curvature is not infrequently found in cases of true ocular torticollis, and it is to determine the presence of any tendency to this that the ophthalmologist should seek the aid of the orthopedist. The shoulder on the side toward which the head is tilted is frequently lower than the other, and definite histories of this condition being noted by tailors and dressmakers are commonly obtainable.

The ophthalmological arguments of the cause of head tilts are not of especial interest to orthopedists. The general rule applying to the lateral rotators is that the head is turned toward the field in which

the paralyzed muscle should work. So, in the case of paralysis of the right external rectus or left internal rectus, the head is turned to the right, and in a paralysis of the left external rectus or the right internal rectus, the head is turned to the left. There seems to be no exception to this rule.

The usual rule regarding elevators and depressors is that in right hand elevators and depressors, namely, the right superior rectus and right inferior rectus, the left superior oblique and left inferior oblique, the head is turned to the right; and in left hand elevators and depressors, namely, the right superior oblique and right inferior oblique, the left superior rectus and left inferior rectus, the head is turned to the left. There are so many exceptions to this rule, however, with such definite proof to substantiate them, that this is not a safe rule to follow.

The head is usually tilted back in a paralysis of an elevator, thus putting the eye in the field of the depressors. The reverse is true when a depressor is paralyzed. Whether the head tilts to the right side or to the left side do not depend on whether the muscle is a right side or left side elevator, as formerly stated, nor does it depend on the torsion effect of the muscles. The study of many of these cases gives every evidence that the head is tilted toward the side of the higher image. For example, if the right superior rectus is paralyzed, the image seen with the right eye will be the higher. Now if this is associated with an homonymous diplopia, the head will be tilted to the right shoulder. If, however, there is present a crossed diplopia, the head will be tilted to the opposite shoulder.

Occasionally is seen a paralysis of the same elevator or depressor in each eye. This is usually congenital and results in a head tilt only when one muscle is more paretic than its fellow. Not infrequently the head is not only tilted to one shoulder, but may be turned to the right or left, and tilted either forward or backward, thus being turned in three different planes.

The treatment of these cases by the ophthalmologist consists in either the use of prisms, or in some operative intervention. Cases of low degree of vertical deviation are at times relieved by prisms, while the higher degrees require an advancement of the paretic muscle or muscles, a tenotomy of the overacting muscle or muscles, or some combination of these procedures. Some cases are better left alone to continue their head tilt. This can usually be determined by carefully studying the case as to fusion sense and diplopia fields.

As causative factors of muscle paralysis, syphilis is the most common, although not in the proportion once claimed. Epidemic encephalitis, anterior poliomyelitis, diphtheria and many toxic conditions are frequently found to be the cause. Some are of traumatic origin. Many are congenital and are divided into two groups: (1) those resulting from an anomalous condition of the muscle itself; and (2) those due to anomalies of the ocular motor nuclei.

Cases of ocular torticollis are much more frequently seen than is usually supposed and require the combined attention of both the ophthalmologist and the orthopedist.

TWO CASES OF OBSCURE GONEITIS*

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DETROIT

WE have recently been required to diagnose and treat two instances of disorder of the knee joint which have been rather unusual, and set each other off in interesting contrast. For instance, while both patients are women, one is about twenty, and the other nearly four times that age. The younger patient came to us after a complaint of years, the older with a duration of months only. In the younger woman a previous diagnosis of tuberculosis, quite consistent with her age, had been overruled; but in the aged patient, despite her years, we have entertained and substantiated a diagnosis of tuberculosis.

Considering the older patient first, we have a woman of seventy, whose past life had been rather uneventful medically and of no particular bearing on her present complaint, although she admitted spells of lumbago and occasional mild stiffness and lameness in the joints. She boasted of a "strong constitution" and had held to an unusually active life in spite of her years, until this illness. Even the latter had not seemed to have any appreciable effect on her general well-being, until the last few months.

About eighteen months before entry, her left knee began to be a little lame after activity and soon to be a little swollen. The symptoms gradually have progressed in degree since then, with an increasing limp; but pain has been constant only lately; there has been no recognized deformity, and complete disability has lasted only a few weeks prior to entry.

During this period, she has felt run-down generally and lost some weight.

She entered the hospital at the instigation of her son, on account of this knee disability, and was admitted to the medical In-Patient Department for study, being referred to this division a few days later with tentative diagnosis of infectious arthritis. The roentgen-ray diagnosis had seemed to support the clinical one. The films show some possible bone changes which Dr. Doub or I might characterize as slightly suggestive of infectious arthritis; in other words, probably a normal knee for her age (and the same is true of our second case). However, the films do show a very considerable tumefaction of the soft parts, as well as increased density of them, which is of considerable significance, especially that noticed posteriorly.

On examining this knee clinically, I was inclined to make a positive diagnosis of tuberculosis. The basis of this is partly instinctive and hard to describe; but of course, there should be certain criteria if this is to be a scientific diagnosis. There is something about the feeling of the joint that is different, and this gives us our strongest impression. In appearance the knee was held in about 20° of flexion and was obviously enlarged, particularly on its medial and anterior aspects. The skin appeared thin, shiny, and a little waxy, but pale or dusky rather than red, and showed obvious multiplication and enlargement of the visible superficial veins. Quite marked local heat was present to palpation, and possibly fluctuation also,

although the patella was not floating. More important was a feeling of doughy, gummy thickening of the periarticular tissues, which followed closely the synovial areas. Tenderness was marked and corresponded to this thickening, front and back. The knee, with pain, could be extended 10° more, and flexed to 45°. Muscular protection was obvious. There was visible and measurable atrophy of the thigh and a very slight enlargement of the calf. The femoral and inguinal glands were slightly larger on this side, but not tender. Temperature and w.b.c. were normal. The chest was negative to clinical and roentgen ray examination, and the woman's general condition found to be quite good.

Inasmuch as the course, the age, and the roentgen ray (to which we are in this disease, however, constantly giving less importance) were against our diagnosis, I recommended an exploratory incision under local anesthesia for purposes of a biopsy. This was done as soon as the patient was transferred to our service, and not only did we encounter a typical edematous jelly-like synovial membrane, but also caseation and pus. The frozen sections were full of tubercles.

Now the treatment of a major joint in which the presence of tuberculosis can be proved is arthrodesis, certainly in an adult. This is the only way that a cure is ever effected, and it is doubtful if a permanent cure with preservation of the joint function has ever been secured in a proved case. However, arthrodesis means a prolonged convalescence, with a considerable period in bed, even in a healthy young adult. The time element or the certainty of such a result in the elderly we thought was too speculative, and the operation itself a rather severe one. The principal needs of this old lady were relief from pain, comfort and a short period of convalescence. We therefore recommended amputation.

This was done the next day under spinal anesthesia. There was no shock. The patient did not miss breakfast, lunch or supper, and could sit up and take fluids from the start. She was allowed up in a week, and in two weeks started using the stump in a temporary plaster and peg leg prosthesis. The stump flaps were made atypical in their construction, long posteriorly and short anteriorly. This was to conserve the greatest possible length of femur and still keep the anterior incision above the upper limits of the quadriceps bursa.

We have the gross specimen of the joint here, though it is much cut up. It is interesting in that we first thought we had another case of pure synovial tuberculosis, which incidentally we have come to realize as a definite possibility even after some years' duration. However, there was found a small area of cavitation in the center of the tibia with a much smaller point of erosion through the cartilage into the joint, indicating an extension from bone rather than into bone.

Our second case is less rigidly susceptible of proof as to diagnosis. This twenty-year-old girl was sent to us from another state by a former patient. Her family history is negative for tuberculosis, but she has a sister in a hospital with some kind of nervous trouble. Her past history is good, and shows nothing of note, save chronic constipation.

Three years ago, she states, her left knee began to be swollen and painful, and after a few weeks she was unable to use it. After various forms of treatment by different doctors, a diagnosis of tuberculosis was made; and about two months after onset an arthrodesis operation was performed that was successful, with no more symptoms in this knee. Two years ago she developed a similar complaint in the right knee, and she states that pain in this knee has prevented any movement of the joint since that time. For a year she got around with crutches, but for the past year has been confined to her room and only able to take a few steps. A year ago, after roentgen ray examination, a diagnosis of tuberculosis was made in this knee, and the same

operation recommended, but not accepted. In the meantime, various forms of rheumatic treatments and serums have been without effect. Casts have also been tried. About three months ago she states she had pain and swelling in the ankle on the same side.

She was admitted on our service on April 19, with a cast on the right leg. This extended only a few inches above the joint and permitted 10° to 15° movement of the knee. When the cast was removed, she would not allow any motion whatever in the knee. The ankle was very slightly swollen but this disappeared after removal of the cast. Movement of the ankle seemed to be considerably limited by pain and muscular protection, but otherwise this joint was entirely negative to examination. The right knee also was entirely negative to physical examination, save for the limitation of motion, the knee being maintained in the completely extended position. There was nothing visible to inspection, no local heat, no enlargement or palpable thickening. There was some general atrophy of the limb but no distinctive atrophy of the thigh. The left knee seemed solid in the completely extended position, but the patella was freely movable to palpation and to reflex contraction of the quadriceps.

Roentgen rays were made of both knees. The left showed fusion of femur and tibia, obviously operative, but no sign of bone pathology, and normal preservation of the chondral area under the patella. The right knee I would consider in the films essentially normal, save for some generalized increased radiability from disuse.

The diagnosis made was hysterical arthropathy of all these joints. A low-grade arthritis would of course be hard to rule out on findings, but with the findings would be inadequate to explain the disability. Remember that according to the patient's statements she has been unable to bend the right knee for two years, and that her family bear this out.

Further to evaluate the status in this right knee, we examined it about a week ago under spinal anesthesia. We particularly wished to determine the question of adhesions or other evidence of intra-articular pathology. When anesthesia occurred and the knee was picked up, it at once flexed nearly 45°, without any audible or palpable tearing or giving way of adhesions. The quadriceps became rather taut, but further flexion gradually occurred from the weight of the leg and finally a little pressure brought about an angle of 90°, still without anything apparent happening in the joint. The ankle seemed entirely free and normal.

The knee was splinted in not quite as much flexion, and the reaction awaited with considerable interest. There was no reaction. This knee, said to have remained extended for two years, and presumably the seat of some articular disease during this time, had now been abruptly flexed 90°; yet there followed no swelling, no effusion, no local heat or redness. Neither was the patient particularly uncomfortable, although on account of considerable obvious tension on the unused quadriceps a little codeine and aspirin were given the first day. Massage was started on the second day and well tolerated, with a little passive motion. At this time the patient would unconsciously move her knee to assist us in adjusting the splint. On the fourth day she started self-aided active motions, that is, with a sling and pulley counteracting the gravity effect of the leg; and when examined recently, showed a self-obtained range of motion of 45.° I am interested to know just what will be the patient's reactions psychically.

I am quite convinced myself of the diagnosis, but not quite as much so as to the form of psychotherapy now required. So far we are working simply on the physical effects of disuse.

In conclusion, then, we have one knee disorder in which a serious lesion, incapable of responding to conservative treatment, yet not likely to be suspected in a patient of such an age or with such roentgen-ray

findings, was found by exploratory operation; and a second knee disorder in which the clinical symptoms had elsewhere led to a diagnosis of tuberculosis, but which turned out to be most probably on a neurotic fixation basis. At this time I might reiterate the proposition that I have previously been putting forth to you that chronic disorder of the major joints can frequently not be diagnosed accurately even by symptomatology, physical findings or roentgen ray findings, and that an incision for biopsy may prevent a great waste of time and useless treatment.

INFECTED MYOMA UTERI

A REPORT OF THREE CASES, WITH REMARKS ON RED REGENERATION*

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BY red degeneration, we mean that form of necrosis or necrobiosis, as it is sometimes called, which converts the ordinary hard fibromyoma into a softer, fleshier mass, the change being accompanied by a reddish or other discoloration which results from the hemolytic action of excess lipoids. This red necrosis is an aseptic process, with hemolysis and tissue autolysis, bacteria being present in those few cases which undergo suppuration, the infection being secondary to the degenerative process. There is no round cell infiltration, whereas in infected cases, where it should be present, it is not marked. Infection is not only singularly rare, but is wholly incidental, and stands in no relation to the cause of the degeneration. The proximity in the cervix and vagina of hemolytic bacteria does not alter this conclusion, nor does it seem to favor the theory that such bacteria can gain access to the affected myoma through these channels.

The typical hard fibroma, on cross section, presents a white, glistening, satin-like, whorled appearance, which, along with its distinct and well-marked encapsulation and its contrast with the surrounding reddish myometrium, is striking and characteristic. Equally striking is the appearance of a uterine myoma undergoing red degeneration or necrobiosis. This change usually affects only one tumor, even if others are present, and generally a large-sized one. Rarely are two or more so affected. The differing tumor is soft in consistency, has a well-marked capsule, is conspicuously colored in red, mahogany, yellow or grey, and is loose textured. In most cases, its appearance is that of raw beef, or of the pink color of Tennessee marble. The extent of the necrosis is variable, sometimes in foci, sometimes in streaks, and at times only about the periphery, the pigmentation fading toward the center and leaving a grey nucleus. Necrotic tumors are usually interstitial, though at times partially submucous, and occasionally subperitoneal. Pedunculated tumors are not subject to this pathology, even though twisting and strangulation take place.

Red degeneration was first described by Gebhard in 1899, but it was not until 1903 that particular attention was given it, when Fairbairn published his essay on its etiology, pathology and treatment. While

an extensive literature has since appeared, little new has been added to his original contribution.

It is acceptable that the colors result from a diffusion of blood pigment through the tissues after hemolysis has taken place, yet the true nature of the pigments are not explained, since the products of such change, namely hemolysis, are not found in the specimens. Hemosiderin cannot be demonstrated by the Prussian blue test, thus eliminating the presence of free iron, and in only one instance have I read of the demonstration by spectrum analysis of hemoglobin.

Strongly favoring the theory of hemolysis is the presence in these specimens of an excess of lipoids, which we know to be highly destructive to blood tissue. This action, however, is usually checked by the normal blood plasma, unless the lipoids are in excess, and thus there can be assumed the presence in the specimen of blood pigments. These lipoids are specifically considered the cause of thrombosis, and thrombosis, by infection or compression, is to some observers a plausible cause of degeneration. The acute onset in these cases would naturally draw attention to a sudden stoppage of the arterial supply, especially when we consider the rather scanty vasculature, arteries that are thin-walled and not communicating with the vessels of the myometrium, and subject to pressure by impaction or crowding, as in pregnancy. It is often noted that intramural fibroids lie loosely in their beds and that large spaces are present between them and the surrounding musculature. This peculiarity affords a plausible basis for disturbed circulation, as in the uterine contractions incident to menstruation, pregnancy and following trauma, for there is a sort of rotary motion of the fibroid within its non-extensible capsule much like that of a mass of dough or putty moulded in the palms of compressing and slowly rotating hands.

While there is a distinct association of lipoids with degeneration, yet the former is not the cause of the latter; and while pregnancy is here supposed to offer a clue to its presence in excess, a number of reported cases were not pregnant. The lipoids are responsible for the hemolysis, and are in excess in the tissues only after the degeneration has taken place, thus facilitating the diffusion of the pigments. In other words, the degenerated tissue favors the acceptance of the hemolyzed blood. It is the continued action of these lipoids in excess of inactivating blood plasma which is accountable for the various hues noticed on section.

The presence of thrombi is not typical, nor can they be proven or surmised to be primary, for degeneration can occur without them and the extent of thrombosis is not proportionate to the amount of degeneration. If the degeneration is presumed to be primary, it is reasonable to presume also that hemolysis induces a deposit of fibrin in a vessel already disintegrated, the thrombus thus appearing secondarily. In the infected cases, however, it is really difficult to deny that thrombi therein arising are the primary factor in the necrosis, the process being similar to others elsewhere in the body.

As to frequency of occurrence, degeneration is found as often as 5 to 7 times in every 100 cases, the pregnant ones in the majority by far. Suppuration in these tumors is conspicuously infrequent, Kelly and Cullen reporting only 11 in 1428 cases, and Deaver saw his first case in 1920 after over 1200 hysterectomies.

Bacteria reported as found are colon, staphylo and streptococci. Gonnococcus is not reported in a single instance. The demonstration of the bacteria in tissue stains is a very difficult attainment, and cultures of tumor tissue are usually sterile also. The case of Dr. H. Vineberg, reported in 1912, is a notable exception to these remarks.

The symptoms usually associated with the onset of degeneration are pain, localized tenderness and a noticeable increase in the size of tumors already known to be

present. The pain may not be severe, though with tumors on the right side, associated as the condition is with a leucocytosis, an appendicitis is incorrectly diagnosed. The acute onset, with definite peritoneal irritation, may mislead the observer into diagnosing such simulating conditions as twisted ovarian cysts and strangulated hernias. A toxic phase with nausea and vomiting accompanies the suppurating types.

Red degeneration as such cannot be distinguished microscopically from necrosis in general, since the discoloration simply accompanies but does not alter the pathological features. The extent of the changes is determined by the appearance of the cell nuclei, the reaction of the cytoplasm to certain stains, the substitution for the muscle cells of hyaline and granular material and the presence of fatty substance. Round cell infiltration is not present (Figs. 3 and 4), which emphasizes the non-infectious nature of the trouble. Fibrin and endothelial debris are found in the blood and lymph capillaries. The tumors are decidedly avascular. A rare variety of fibroid, described by Virchow and called the angeomatous type, shows a large number of thin-walled blood vessels. Two such cases are reported in the English literature. A satisfactory summary of the pathological features is the following, by Lockyear: (1) irregular and scanty nuclear staining (nuclear 'ghosts' at times); (2) granular and hyaline degeneration; (3) replacement of muscle cells by fatty tissue; (4) endothelial shedding, thrombi and deposits of fibrin; and (5) rarely, pus formation after infection.

It would appear that the treatment of this condition is myomectomy or hysteromyomectomy, and yet the opinion is stressed by a number of observers, that with the complication of pregnancy, the patient should and can be tided over until such time as an elective cesarian or myomectomy can be done, or be carried through what might in all respects be a fairly normal labor. It is believed that most myomata, even low down, will, with advancing gestation, rise out of the pelvis and not be obstructive, and that their proper treatment can be satisfactorily conducted near or after full term.

The prognosis, in operation, is uniformly good, and should be no different from the surgery of undegenerated cases. Quite a few cases are recorded of myomectomy in the course of a pregnancy without resulting miscarriage or abortion. However, in the infected cases, mortality is unfortunately very high, ranging from 27 per cent in Kelly's estimate to 50 per cent in Basso's and 70 per cent in Berger's. These high figures would make it most important that operation be undertaken early in the degeneration, before infection, if indeed such diagnostic acumen could be applied. In a patient known to have myoma, a sudden attack of localized pain and tenderness and a definite increase in the size of the tumor should lead one to the diagnosis of degeneration; the advent of toxic symptoms, associated as it would be with peritoneal irritation, high temperature and leucocytosis, should establish the diagnosis of bacterial invasion. One of our three cases (Case II) was correctly foreseen.

SUMMARY

Degeneration of fibroids is associated with the presence of lipoids, the accumulation of which may be dependent on the presence and extent of thrombosis or infection. Infection is never primary. The hemolytic action of the lipoids is restrained by the blood plasma, excess of lipoids giving a red discoloration, and by its continued action, the red being replaced by deeper hues; and finally, in extensive changes, by a grey color. As degeneration can occur without color changes, a better term would be simply, "Degeneration," or, "Degeneration with red or brown or grey discoloration," whatever the color happens to be. The hard consistency of some of these tumors may give no indication, exteriorly, of the changes noted on section or microscopy. Thrombosis is not

thought to be primary and is not always present; in infection, it is likely to be primary. The microscopy is characterized by the presence of hyaline and granular degeneration, replacing or separating the muscle fibers remaining by the presence of fat and karyolysis. The presence of fat is singular and probably results from muscle fiber change. There is no round cell infiltration. Pregnancy is a predisposing factor. Infection gives rise to toxic symptoms and

before this sudden illness. Typhoid and pneumonia two years ago. Has had two children and two miscarriages. Menses began at thirteen, were regular and continued from 3 to 5 days, rather more profuse the past two years, and for the past two months accompanied by pre-, per- and postmenstrual pain. The pains were of a bearing-down character, felt in the lower abdomen and also in the back. Her present illness began two weeks ago, with onset of regular menses, rather more than usual pain in the lower abdomen and back, occasional

FIG. 1a.

FIG. 1b.

is fatal; early operation, with no resulting infection, can be successful. Operation in degenerated fibroids is indicated, except in such cases complicated by pregnancy where temporizing until full term may happily result.

Below is reported a case that prompted this brief study, followed by two others, one of which (Case II) was correctly diagnosed before operation, and the other was an accidental find in a patient operated on for bilateral adnexal suppuration.

CASE REPORTS

CASE I. L. G., forty-three years old, colored, married. Entered Harlem Hospital on June 13, 1927, complaining of pain in lower abdomen and appearance of a mass, increasing in size, and not known to her to have been present

chilly feeling, and a noticeable increase in the size of the abdomen, within which she herself was able to make out a mass of which she was not previously cognizant. She 'did not feel at all well,' had nausea and vomited once. In spite of her last menses having passed only ten days prior to admission, she was still thought to be pregnant, and sought hospitalization, owing to her peculiarly sick condition.

On admission, she looked acutely ill, with temperature 100°, w.b.c. 15,400, polymorphonuclears 78 per cent. The Wassermann was negative. The patient was well developed and well nourished, and exhibited abdominally a globular mass, hard, freely movable, painful and tender, reaching up to within the umbilicus. Vaginally, two other fibroids were made out. A provisional diagnosis of ovarian cyst and twisted pedicle was made and operation

advised; this advice was not accepted; three days thereafter, temperature went to 103, and again on the fifth day to 105. Operation was then undertaken, on June 21, 1927, eight days after admission. The specimen shown (Fig. 1) was removed, by supracervical hysterectomy, leaving both the adnexa. In preparing the uterus for removal, it was lifted out of the pelvis with a cork-screw. Not suspecting trouble ahead, the operation proceeded and was speedily finished. Unaware of what was waiting, the specimen was sectioned

CASE II. S. J., aged thirty-seven, operated upon at Harlem Hospital on June 24, 1927. She was about seven months pregnant (fourth gravidity) and gave the history of sudden illness about three weeks ago with severe abdominal pain, frequent vomiting, occasional high fever, and a definite history of a chill. Of significance is the fact that at the beginning of her illness, though not subsequently, she noticed an abnormal development in the size of her pregnancy, and complained especially of pain in the left upper quadrant. The pain

FIG. 2.

FIG. 3.

in an unsterile fashion, and to our great surprise, a quantity of pus flowed away, and the red fibroid was noted. No smear was taken at this time. The fibroid so affected was the largest of thirteen, and about the size of a large orange. The fluid had a fishy odor, the capsule was well defined, though loosely attached in places, with minute clots of blood appearing in the loose areas. The consistency was hard, the color that of washed meat. The pathology present was that described above, and is shown in Figures 3 and 4. A contrast with an ordinary fibroid is offered in Figure 2. For the relief of paralytic ileus, an enterostomy was performed on the fourth day, and huge quantities of pus were taken from the much-distended small intestine. The patient died on the morning of the fifth day postoperative, cultures from the peritoneum showing pure colon bacillus.

was severe, almost constant, giving the patient, who was an unusually robust and pain-enduring type, the appearance of acute severe illness. Temperature on admission was 104, pulse 90 to 100, leucocytes, 16,200, polynuclears 82 per cent and lymphocytes 16 per cent. A small, hard, tender mass was palpable, attached to and movable with the uterus, situated at the site of acutest tenderness, namely, at the fundus of the enlarged uterus, at the left.

At operation, on the day following admission (June 24, 1927), the tumor was found as outlined, surrounded by recent adhesions which held down the neighboring intestines and omentum; these adhesions separated, the mass shelled out and proper closure was affected. The patient never seemed to be able to throw off the septic phase she presented before operation, her robustness evidently no match

for the toxemia with which she was coping. She miscarried on the tenth day postoperative, and died on the twelfth day.

On section the tumor, the size and shape of an egg, was rather soft, grayish in color and had at its center a small cavity, containing a sanguinous pus without special odor. The pathologist's report follows:

"The wall of the cavity is shaggy and wrinkled, and of a grey, opaque tissue, similar to that which appears, in shreds, in the cavity. No thrombi visible. Microscopically, a section
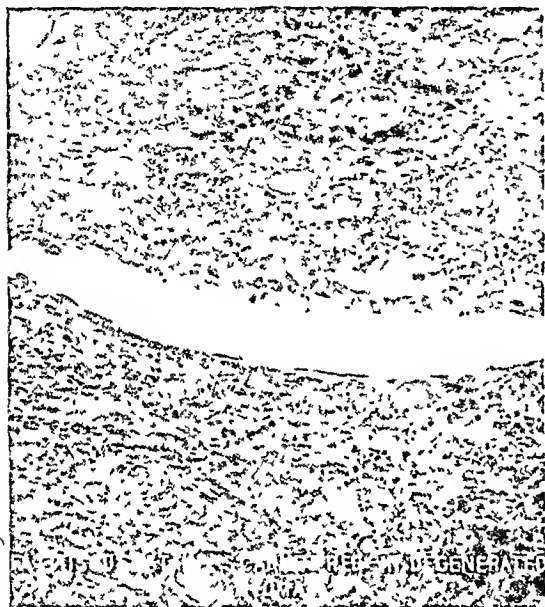
FIG. 4.

of the cavity wall shows the muscle fibers poorly stained and in general pycnotic and fragmented; moderate amount of edema separating the fibers. Between the muscle bundles and muscle fibers, one finds a considerable number of fairly well-preserved and also much fragmented polymorphonuclear neutrophiles, and nuclear debris. These materials occur in ill-defined patches that are generally distributed throughout the specimen, always apparently paralleling the direction of the muscle fibers, and more noticeable near the central edge of the section. A section removed from the

outer wall revealed muscle fibers poorly stained, showing either no nuclei (the more usual phase) or the veriest shadow of a large, oval, very vascular nucleus. The fibers were small, the ends rounded or frayed, striations very indistinct. A very moderate polynuclear leucocytic intermuscular infiltration was present. In neither of the sections examined were any vessels thrombosed, thickened or narrowed."

CASE III. A. L., aged twenty-five, operated upon at the Harlem Hospital on May 2, 1927, for bilateral adnexal suppuration and multiple small fibroids of the uterus. There was no hint in the history that she was having any trouble in the uterus, the symptoms pointing entirely to the adnexa, from which she had suffered on a previous occasion. She was not considered especially ill, and was operated upon at a selected time, twelve days after admission.

One of the fibroids contained pus, the smear of which was negative, though the culture showed staphylococcus albus. There was no discoloration. The patient got well, and was discharged on May 15, 1927.

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PSEUDO-PANCREATIC CYST

WITH REPORT OF TWO CASES

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IN the daily hospital rounds, the discovery of a patient who presents an upper abdominal tumor seems at once to arouse general interest and to provoke more than the usual discussion as to the diagnosis of the condition. Kidney, spleen, liver and gastrointestinal tract are promptly brought under suspicion; less commonly, perhaps, is the pancreas in itself thought to have any association with the pathological picture. If we can only keep in mind, however, that such a tumor mass may be the result of some lesion of the pancreas, a true appreciation of the case may be more easily reached. Because of the general interest, therefore, in upper abdominal tumors, and the comparative infrequency of pseudo-pancreatic cysts, as well as the fact that a clear conception of just what these cysts are is not always held, a brief review of the subject, with the presentation of the cases here reported, seems justified.

What, then, is a so-called pseudo-pancreatic cyst? As Moynihan states, the term "pancreatic cyst" is applied to any fluid tumor within the pancreas or "associated with it." The retention cysts of the pancreas, the proliferation cysts (cystic adenomas and carcinoma), the congenital, the hemorrhagic cysts, the hydatids and dermoids comprise the true cysts of the pancreas and are all contained within the substance of the gland itself. The pseudo-cysts, on the contrary, are not within the pancreas, but are usually included in any discussion of the true cysts because of their "association" with it. They arise, it is now generally believed, as the result of a laceration of the gland accompanied by an extravasation of fluid into the lesser peritoneal cavity which the cystic mass then occupies. Cathart describes the process as follows: "An injury causes a laceration of

the gland. This is followed by an extravasation of blood and with this is mixed the pancreatic secretion from the torn ducts. Not only is a constantly increasing fluid thus added to the original hematoma but the collection of fluid probably becomes irritating in character. It would thus tend to excite the formation of a capsule around it, and by chemical irritation and tension would gradually increase in size." Such a cyst, therefore, is seen to be merely a collection of fluid within the lesser peritoneal cavity, and to be associated with the pancreas only in so far as it originated from an injury to that organ.

The first case of this sort reported in the literature was Kuklenkampff's in 1882, and was thought to be a true cyst, along with several others reported at this time. Jordan Lloyd was probably the first to recognize the true pathological picture and from his study drew the conclusion that they were of traumatic origin, were merely fluid accumulations within the lesser sae, and could not rightly be considered as true cysts of the pancreas.

A consideration of the position of the gland as it lies across the body of the first lumbar vertebra, with a complete absence of fat in the tissue between it and the parietal peritoneum, even in fleshy people, makes it clear that it is not completely protected from injury. Particularly when the stomach and transverse colon are empty, the pancreas may be crushed between an external force and the body of the vertebra, and the parietal peritoneum covering it being particularly adherent, it is easily torn. Arising behind the stomach, the collection of fluid, as it increases in size, gradually forces that organ forward, pushing it upward usually, and to the right. As a rule it makes its way between the stomach above and the transverse

colon below, its area of dullness on percussion usually being surrounded by the tympany heard over those organs. Occasionally, however, it presents above the stomach or below the colon, frequently displacing them to a considerable extent, as shown in the roentgen-ray examination or at operation.

The diagnosis of pseudo-pancreatic cyst is sometimes confusing at first, especially as the mass seems at times to vary in size or even apparently to disappear. This, however, is due to the varying degrees of distension of the stomach or colon, these organs when distended with food or gas accentuating the appearance of abnormal swelling in the upper abdomen, and again when collapsed minimizing it. The history of the case, however, is usually of decided value. It almost always reveals some previous trauma to the upper abdomen, a blow or kick, or a crushing injury as from the passage of a wheel over the abdomen. This trauma may have been slight, with only transient disability, or it may have presented all the signs of serious intra-abdominal injury, with collapse, pain, vomiting, rapid pulse and other evidence of intra-abdominal hemorrhage, with rigidity, tenderness and leucocytosis. If the case has been unassociated with injury to other viscera, however, which might otherwise compel immediate intervention, these symptoms may gradually subside, so that under conservative treatment the patient may appear to have completely recovered and even be discharged from observation.

Usually within a month, however, there may be a return of symptoms, a recurrence of pain which may be severe, and a gradual and sometimes rapid appearance of a tumor mass in the upper abdomen. Vomiting, general restlessness and constipation are common and dyspnea, anemia and an unduly rapid loss of strength frequently follow. The tumor mass may appreciably increase in size day by day. It is characteristic in shape and usually lies in the left hypochondrium or in the epigastrium. It may extend even into the umbilical region, however. Its area of dullness is not continuous with that of the liver or spleen as a rule, but is surrounded by a zone of tympany due to its relation to the hollow viscera.

Thus, with a history of trauma, the development of symptoms as outlined above, and finally the appearance of the characteristic tumor, the diagnosis of pseudo-pancreatic cyst should be clear. There are several conditions, however, for which it may at times be mistaken. A left-sided hydronephrosis may present many of the features of a pseudo-pancreatic cyst; but by means of cystoscopy with ureter catheterization and roentgen-ray, a differentiation between the two is expected. Hemorrhagic cysts of the spleen do not as a rule extend so far to the right; a subdiaphragmatic abscess runs a febrile course with a blood picture indicative of suppuration, and the roentgen ray as a rule shows a greater elevation of the diaphragm. With an ecchinococcus cyst of the liver there is no surrounding zone of tympany and the characteristic crepitation of the daughter-cysts, if elicited, will dissipate all doubt. An ovarian cyst should be differentiated by its greater mobility, by the more diffuse swelling and usually lower position. An abscess of the abdominal wall, aside from the evidence of suppuration, fails to displace the abdominal organs and is naturally more superficial. Other retroperitoneal tumors lack the history common to pseudo-pancreatic cysts and usually the sense of fluctuation also. From true cysts of the pancreas itself, however, a differentiation is sometimes almost impossible; both may occupy the same region, both may be of a similar shape and consistency, with identical physical signs. Even at operation the diagnosis may not be certain. Examination of the cystic contents itself cannot be relied upon to differentiate the two conditions, as the presence of sugar-reducing and fat-splitting enzymes of the pancreas may at times be demonstrated in both. If a section of the wall of the cyst, however,

is removed for microscopic study, the distinction can be made, for only in the case of the true cyst will a lining of columnar epithelium be found.

The treatment first attempted in connection with pseudo-pancreatic cysts was aspiration of its contents. This met with such disaster, however, through rapid and fatal peritonitis from leakage of the fluid into the general peritoneal cavity, if not from accidental perforation of the hollow viscera, that it was quickly abandoned. Extirpation of the cyst, partial or complete, met with somewhat more favorable results, but soon gave way to simple incision with drainage and marsupialization of the sac. This has been found to be highly satisfactory and has now long been the recognized treatment for the condition. The following tabulation from Godel, who collected 227 cases, shows the value of marsupialization in these cases.

	Cures	Deaths	Mortality, Per Cent
Total extirpations......	28	25	3	10
Partial extirpations....	9	4	5	55
Marsupializations......	190	183	7	3
Total number of cases	227	212	15	6.5

Kijewski, who collected 240 cases, had similar results, though not so striking:

	Cures	Deaths	Mortality, Per Cent
Total extirpations......	43	35	8	18
Marsupializations......	197	174	23	11
Total number of cases	240	209	31	13

Mocquot and Constantini in a series of 88 cases give a mortality of 12.5 per cent, with marsupialization as the only treatment employed.

Ordinarily an anterior abdominal incision is made through the left rectus over the most prominent portion of the mass. As this usually presents through the gastrocolic omentum, the incision may then be carried down in this area until the cyst is encountered. The fluid is then removed by means of an aspirator, the cyst being punctured with a trocar after the general abdominal cavity has been thoroughly protected by suitable pads. After the collapse of the cyst, the perforation in its wall may be somewhat enlarged and a dressed tube inserted and held in place by means of a purse string suture of chromicized catgut. In addition, the cyst wall may be sutured to the parietal peritoneum and the abdomen then closed. There is usually not an excessive amount of drainage, though occasionally a pancreatic fistula may persist. Mocquot and Constantini report such fistulas in 41 of their 88 cases. These all closed, however, within one to three months. For a persistent fistula, these writers suggest injections of astringent solutions, an antidiabetic régime and, if necessary, an anastomosis of the fistulous tract with some portion of the stomach or duodenum. Fistula, however, apparently is not a complication to be dreaded.

Instead of the anterior abdominal incision, Cathcart employs one in the lumbar region, claiming for the posterior incision more favorable drainage, an extraperitoneal approach to the cystic mass and avoidance of risk of postoperative ventral hernia. Such an incision has much to commend it when the diagnosis is well established. If there is any need for exploration, however, the anterior approach is probably preferable.

The following cases here reported were both traumatic in origin and presented many of the features usually found, though they varied somewhat in the severity of the symptoms. The first case was particularly instructive, as it was under observation from the time of the original injury until discharge from the hospital after operation. Both cases responded to simple marsupialization with uneventful recovery.

CASE REPORTS

CASE 1. V. B., a little girl six years of age, was admitted to St. Vincent's Hospital on June 17, 1925, in a state of shock, having been knocked down by an automobile. The wheel, however, had apparently not passed over the abdomen. There were no external evidences of injury to the abdominal wall, no asymmetry of the abdomen, no abnormal dullness, no palpable masses. There was some

epigastric tenderness, however, and slight rigidity, and in view of the shock, together with epigastric pain and vomiting, a tentative diagnosis of internal injury with possible hemorrhage was made. Intervention at that time, however, did not seem indicated and no operation was done.

The little patient came out of her shock, but during the next few days the epigastric pain persisted and in fact became the outstanding symptom throughout her illness. At times it was severe, coming on in exacerbations, gradually to subside. Vomiting also was frequent. Tenderness in the left upper quadrant with muscle spasm most marked in that region was noted on the 19th.

A blood count at this time showed 18,600 w.b.c., with 80 per cent polymorphonuclears. Shifting dullness indicated free fluid within the abdomen, in the general peritoneal cavity. The child's general condition, however, was not yet alarming and there still seemed to be no sufficiently definite indication for operation, and no lead as to the exact pathology. Tenderness, pain and vomiting, however, persisted. Abdominal distension developed, at times marked, at others less noticeable.

Finally, on July 15, twenty-eight days after her injury, the abdomen at this time being only slightly distended, a mass was detected in the epigastrium and left hypochondrium and the signs of fluid within the general abdominal cavity had gone. This mass was obviously a localized collection of fluid, tense and with distinct fluctuation, and it rapidly grew larger in size.

Without a definite diagnosis, though expecting to find a hematoma which had become encapsulated, operation was performed on July 21, and a large pseudo-pancreatic cyst presented through the gastrocolic omentum. The fluid was evacuated and the cyst marsupialized; the fluid was brownish in color, alkaline in reaction, contained numerous red blood cells, but was negative for pancreatic enzymes. The Mayo drain which had been sutured within the sac was removed on the fifth day after operation and a small rubber tube substituted. Drainage was slight. The cavity was occasionally irrigated with Thiersch's solution and later with saline. The child made a good recovery with entire subsidence of symptoms. On the fifth of August the wound was entirely healed and on the seventh the patient was discharged home.

Subsequent examinations have shown that there has been no recurrence of symptoms, and that the sinus has remained closed.

CASE II. M. B., white female child three years of age, admitted to the hospital May 28, 1926, because of a swelling in the upper abdomen that her parents had noticed. The child had been run over by a wagon on April 13, 1926, the front wheel crushing the abdomen. She had been removed to a hospital where she remained under observation for nine days. A week after her discharge from the hospital a mass was noted in the upper left quadrant, and for this the child was admitted to the Children's Surgical Service at Bellevue Hospital.

There were no particular symptoms at this time, no pain or vomiting, and aside from a distinct anemia, merely the presence of the characteristic swelling with the history of a previous trauma. The mass lay in the left upper quadrant, extending from under the costal border to the umbilicus and to the right slightly beyond the midepigastrium. It measured $10\frac{1}{2}$ by 12 cm., was firm though with a distinct sense of deep fluctuation, dull on percussion and was unaffected by respiratory movements. A surrounding zone of tympany was readily elicited, and with these findings, and the history of abdominal injury, the diagnosis of pseudo-pancreatic cyst was ventured.

At operation on June 1, a large, tense, cystic mass was found to occupy almost the entire upper half of the child's abdomen, effectually preventing much exploration. It arose from behind the stomach, which it was markedly displacing upward and to the right, and was most easily reached through the gastrocolic omentum, the transverse colon being below. Accordingly it was aspirated at this point, almost two quarts of greenish-brown fluid under considerable tension being removed. A Mayo drain was then sutured into the opening made in the cyst and the cyst wall in addition sutured to the parietal peritoneum.

The child made a perfectly smooth recovery with very slight drainage from the wound, the cavity being Dakinized to assist in its obliteration and entirely closing three weeks after operation. Up to the present time this child also has remained well, the operative scar being firmly healed and abdominal examination showing no evidence of a return of the cyst.

In closing I wish to express my gratitude to Dr. S. J. Walsh and to Dr. Carl G. Burdick, directors of the surgical services at St. Vincent's and Bellevue Hospitals respectively, who kindly gave me permission to report these two cases.

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EDITORIALS

A PILGRIMAGE into an unknown field is to be undertaken with trepidation, when a trail has already been blazed in brilliant fashion by a predecessor. It is with a distinct feeling of apprehension that I carry on where Doctor Brickner leaves off.

Everywhere is seen the process of evolution. A journal devoted to surgery is no exception; somewhere in a distant past it rises; it has its dark days; it takes on parts that soon atrophy and die or, in time, become dominant factors in its existence. It passes into new hands. One editor lays down his blue pencil and another picks his up. The individual fades from the picture, but the publication continues life and constantly takes on new aspects.

When one assumes a new editorship, he does so with high hopes of building firmly and high upon the foundations so solidly laid down for him. Feeling that there is a distinct place for THE AMERICAN JOURNAL OF SURGERY in our professional lives, and with a keen desire to fulfill this need to its fullest extent, to make the JOURNAL stand out and become a looked-for essential—these are some of our aims.

But evolution is slow and growth does not reach its fullness overnight. The general type of subject material will continue. New departments may be attempted, a different arrangement of material may be tried, and new features offered for your approbation. The main part of each issue will be composed of original scientific communications. Many articles will be well illustrated. One department will be devoted to case histories; another to the results of bookshelf browsing, followed by a review of the latest books. There will appear regularly a letter from abroad or from the Orient or South America done in a human way and with fairness. Space will be devoted to things of interest to physicians in current lay periodicals, and from time to time a page on the surgical-legal aspect of prob-

lems done by an attorney who knows the subject will be offered. Frequently four to eight articles will be published coming from a recognized surgical clinic or group, or from a group of surgeons from one city or section of the country.

After long debate and deliberation it has been decided to omit abstracts, for the reason that they are so thoroughly done by *Surgery, Gynecology and Obstetrics* and the *Journal of the American Medical Association*. The abstracts in *The American Journal of Roentgenology and Radium Therapy*, also, are the most complete in their field of any journal in the world. To insert abstracts covering but a part of the latest literature, a sort of willy-nilly affair, strikes us as a waste of paper and printer's ink. Perhaps the subscribers to THE AMERICAN JOURNAL OF SURGERY hold different views. If so, we should be glad to hear them, and to be guided by the replies received.

THE AMERICAN JOURNAL OF SURGERY is the official organ for a number of scientific bodies. But only papers of the soundest merit read before these organizations will be considered. Discussion will be limited to added information offered. If, in the opinion of the editor, an article stands out more prominently without discussion, such discussion will not be put into type. In other words, it is our aim to strive for originality, to insist upon terseness without lessening interest or sacrificing literary flavor.

Much material is on hand for future issues, but we are on the alert for articles with the stamp of originality and authority. Once an article is accepted early publication is assured.

In time we hope to balance the JOURNAL with two or three articles representing the surgical specialties, and not publish too much along one line.

And so we begin our editorial journey, with eyes on certain fixed stars, a broad trail blazed in the past, with high hopes that suggestions and constructive criticism will come to us from many hands, and that

the readers of THE AMERICAN JOURNAL OF SURGERY will look forward to receiving it each month with interest and delight.—
T. S. W.

BRITISH LETTER

DURING the past year we have been celebrating in England the centenary of the birth of Lord Lister. These celebrations have been held in London, Edinburgh and Glasgow, for in each of these cities he was in active practice and carried out some particular phase in the development of his system of treating wounds. It is pleasing to note that distinguished surgeons all the world over made it their business to attend these functions and some gave addresses recalling one or another aspect of his work. His Majesty the King received the delegates in London at Buckingham Palace. The Prime Minister, Mr. Baldwin, paid tribute to his memory in the great hall of the British Medical Association, and aptly quoted that great ambassador of America, Mr. Bayard, who in proposing Lister's health at a dinner of the Royal Society once said, "My Lord, it is not a profession, it is not a nation, it is humanity itself which, with uncovered head, salutes you."

Short addresses were also made by Professor Henry Hartmann of Paris and Professor Max von Gruber of Munich. It was London's privilege to have another address later by a famous professor of surgery, namely, Professor von Eiselsberg of Vienna, who gave the second Lister memorial lecture at the Royal College of Surgeons of England. Eiselsberg knew Lister personally; when an assistant of Billroth he was sent by his chief to King's College Hospital, London, in order to learn at first hand Lister's methods. The main theme of his discourse developed from the fact that the great progress made in surgery was due to the fundamental work of Lister and his antiseptic system of treating wounds. There were still those, he said, who declared that

Lister had discovered only the antiseptic system and that asepsis was an independent discovery; but in his (Eiselsberg's) view it was quite clear that asepsis was the outcome of the Listerian train of thought. One great drawback to the surgery of today was that the enthusiasm of some surgeons prompted them at times to attempt too much; who on account of the diminution of the field of danger in the undertaking of operations of choice with the modern technique were unable to resist carrying out a stereotyped surgical procedure when without sufficient justification. As a consequence, indifferent and even bad results must follow. Lister, with his lofty principles and his habit of careful investigation, would have been the first to condemn such unnecessary operations. Every step forward in surgery might cost life; therefore before any such step was taken results should be checked by anatomical and physiological research and animal experiment. ⁂

Professor von Eiselsberg especially deplored unnecessary operations on the stomach and also in the treatment of fractures. He emphasized the fact that indiscriminate gastroenterostomies had undoubtedly brought many evils in their wake, so that in recent years there had been an outcry against the operation itself, although it is certainly justifiable and useful in particular cases.

There is no comparison between the status of the surgeon of today and that of his predecessor a hundred years ago. In those days if an operation was successful it was due to the forethought of the physician, and if it failed it was owing to the clumsiness of the "barber surgeon." Today the surgeon stands on the same social footing as the physician, and coincident with this rise in status has been the growth of efficiency in the nursing profession. Both now assume greater responsibilities, dependent for a successful issue upon the careful cooperation of the two professions, medicine and nursing.

Many problems are left for the rising generation to solve, more particularly with regard to cancer, a disease which is now being thoroughly investigated on scientific lines. Then there are further therapeutic possibilities indicated by experiments with serum. Some day, perhaps, there will be forthcoming a polyvalent serum which will protect against all pathogenic organisms. If this dream were realized it would greatly simplify all operative precautions. Before medical science could reach its present level an immense amount of plodding work and research had to be gone through, untold nights spent in vigil and numerous sacrifices of pleasure and ease had to be made. The world knows nothing of the silent performance of duty which our profession demands both day and night. What Lister has given to the world should never be forgotten. He introduced a new and truly beneficent age of medicine, and his name and the glory of his work should never be dimmed. His achievements demand our greatest admiration. Great Britain can be justly proud that it is one of her sons whose name will ever be associated with the momentous progress of surgical science in modern times.

Curiously, Sir Berkeley Moynihan in his address "The Approach to Surgery," delivered at King's College Hospital Medical School, covers some of the ground touched on by Professor von Eiselsberg. He says "Surgery is in these days both science and art. As science it accomplishes the purposes for which every science exists: to acquire direct knowledge, to accumulate facts, from a multitude of individual examples to raise a broad truth, to weave generalizations, in its highest accomplishment to link cause and effect . . . As art surgery is incomparable in the beauty of its medium, in the supreme mastery required for its perfect accomplishment and in the issues of life, suffering, and death which it so powerfully controls."

The changes that have taken place in surgery and the great increase in the number, intricacy and scope of operations

have made it far more necessary than ever before that the surgeon should be a skilled craftsman. To practice the craft with something near perfection a man must surrender his whole life. To attain a certain facility in operative work is not difficult; to imitate the master's methods and to follow the movements of his skilled hands is within the easy competence of many. Man, Aristotle tells us, is the most imitative creature in the world, and he learns at first by imitation. It is natural for us all to delight in works of imitation, but in imitation there lies a great danger. Many of the operations of surgery have now become so standardized, so perfected and simplified by a multitude of workers, that they can be imitated by others with a degree of success which, though falling short of the best, is yet, by comparison with the results of a generation ago, worthy of high praise. This has unhappily led to the too frequent performance of operations, and to their performance by those whose judgment has not kept pace with their technical accomplishments. Perhaps the most abused operation in surgery is gastroenterostomy. A distinguished continental surgeon has fathered a paper by one of his pupils on "Gastroenterostomy a Disease." This paper states: "The anastomosis is in all truth a disease in the absence of a sufficient cause or in an inartistic and vicious manner. That it is frequently performed when it is not needed, that it is performed by the clumsy imitator, is certain. Many of us have the bitter duty of undoing such anastomoses or of resecting the ulcer which has developed in consequence of them. The physician who sees such cases condemns the operation: in that, surely, he is wrong; his strictures and ours should not fall upon the operation but upon the operator. I conceive that a duty rests upon the physician greater than he realizes. When a physician for whose talents and devotion I have great respect expressed his regret that he could not agree with my advocacy of surgical treatment for chronic

incoercible duodenal ulcer because the mortality of the operation practiced upon his cases was over 10 per cent, I was constrained to say that were the mortality in my own hands so high, I should abandon surgery. The duty rests upon the physician, if he advises operation, to point out that the mortality of operative work varies with the operator; that though in general terms there is an average mortality for every operation, in cases of difficulty or danger, where the fine issues between medicine and surgery must first be decided, and much depends upon experience, the choice of a competent and practiced operator is necessary."

Further he declares: "A change in the training of the surgeon is imminent and is certainly overdue." He believes that the approach to surgery is not as formerly by the study and teaching of descriptive anatomy, which has been for generations the custom of one in this country desiring a post on the surgical staff of a large hospital. His plan would be, to quote his own words: "Were my days to come again I should, after leaving examinations behind, spend the time necessary to make an adequate knowledge of human anatomy my permanent possession, and should then escape to experimental research and in a community of like-minded people, endeavor to train myself for the high destiny of a surgeon, the one man who may engage in direct research. My time would be spent in the laboratory, where a youth of plastic mind may learn the methods of approach to new problems or to new extensions of old problems; where old knowledge is merely an impulse to the search for new; where intellectual dissatisfaction is victor over narrow complacencies; where the religion of research inspires him and equips him for his work in days to come. If surgery is to be something more than a wonderful craft, if it is to be the instrument of research which I believe it to have been, and destined to be in the future, those who practice it must have their minds shaped and strengthened by con-

flict with unsettled problems, not cramped and sterilized by monotonous exercise within a narrow province of static knowledge. Their minds must be trained in the laboratory in analogical research, so that they may be more effectively exercised both in the operation theater and in the wards upon direct research; not, I need hardly say, to the neglect of the dissecting room, but to its relegation to a subordinate position. The comradeship of laboratory workers and clinicians should be intimate and unbroken. The scientist at work in the laboratory can never reap the full reward of his lonely researches without close and loyal collaboration with the clinician. Nor can those who serve the same cause in a different atmosphere give to their patients the best aid of medicine and surgery without the help of the scientist. The training of the surgeon must not only allow, it must urge, his mind to stray beyond the hard boundaries of old knowledge, over the edge of firm beliefs, into wide territories as yet unexplored and even undivined. In this way only is there escape from the danger which besets the surgeon in the future: the peril of a facile automatism."

Much has been written lately and many discussions have taken place in the medical societies with regard to that ever present problem, "Hospital Accommodation and Administration." Papers were read on the subject in the section of Medical Sociology at the Annual Meeting of the British Medical Association in Edinburgh, and created a very interesting discussion. It was quite evident that although a policy has already been propounded and accepted by the Association it by no means satisfies a considerable number of the members of the profession. The gist of the policy is that the system of Voluntary Hospitals should be preserved and that their work should be extended to other than charitable patients; and furthermore that there should be an attempt at coordination of all types of hospitals under the direction of advisory committees so as to avoid overlapping and

unnecessary expenditure. We must remember that hospitals in this country originally were solely for the sick poor; this character was maintained practically until about thirty years ago when a few hospitals instituted a small number of paying wards. Since the war, however, there have been undoubtedly greater calls upon the existing institutions, and voluntary subscriptions from the more wealthy people have been decreasing rather than increasing. This is, in part, owing to the inroads made on their incomes by increased taxation, and also because of the claims of the state now made upon them as employers of labor for the compulsory insurance of their employees for accident and for sickness benefits. The hospitals, therefore, have had great difficulties in finding the money necessary for working expenses, and many fall back on assistance from special funds, particularly the King Edward VII Fund presided over by the Prince of Wales. However, most institutions now make good by adopting what is known as Workmen's Contributory Schemes, which imply a weekly collection at the various mills and workshops, where the employees agree to have sums varying from a penny to threepence a week deducted from their wages.

These schemes are generally based on what is known as the Leicester Scheme, the money going to a central fund under the control of a small committee which allocates sums to various hospitals and demands for their subscribers practically free maintenance and treatment. No payments whatever are made to the medical staff of the various institutions, as a rule, from these workmen's collections; consequently there occurs at times the most flagrant abuse of what were formerly charitable establishments and of course usually at the expense of the medical profession.

In his presidential address to the Bath and Bristol Branch of the Association, Mr. Hey-Groves of Bristol has done a great service in challenging the present system on the grounds of inefficiency.

The hospitals are often badly situated and do not lend themselves to suitable alteration and consequently cannot or do not obtain the necessary premises and assistance to undertake modern scientific work. They are sadly short of beds for the number of applicants for admission and therefore the overflow is tending to go to the municipal hospitals where the staffs, though perhaps limited, are certainly paid for the services they render.

The management of the voluntary hospital must maintain the strictest economy to carry on its work and the modern methods of treatment are actually neglected on account of lack of funds. Mr. Hey-Groves instances the growth of radiotherapy and the expense necessarily incurred in its development for laboratories and skilled assistance, and relates that a city of such importance as Bristol with a population of over half a million has as yet secured only 5000 pounds' worth of radium, and still lacks the necessary central laboratories, technical assistance and proper continuous financial support; whereas the same city does not hesitate to spend out of public funds a quarter of a million on the housing of mental defectives.

Mr. Herbert Eason of London, opening the debate on this problem at the Edinburgh meeting in July last, declared himself in favor of an amalgamation of the voluntary and municipal or poor law hospitals under a joint board of management which would control the medical and nursing staffs. He suggests that there should be a common visiting staff for the two hospitals in order to insure a common standard of treatment, but the municipality should pay for the services of the staff at the municipal hospital. This hardly seems a practical proposition, since the two kinds of hospitals will both be used eventually for the whole working class population, and not, as in the past, as charitable institutions for the sick poor.

From the foregoing it is plain there is at present a great confusion of ideas with regard to the policy of the hospitals in this country, and unfortunately there is being developed an iniquitous system which requires and demands highly technical and devoted services from the medical profession, but does not deem these services worthy of any financial remuneration.

JOHN H. WATSON, M.D.
Burnley, England.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

THE DOCTOR AND HIS BOOKS*

Harvey Cushing, m.d.

BOSTON

WE ARE come here today because sixty years ago, as you have heard told, a Cleveland physician of blessed memory, Dr. Isaac N. Himes, took out a subscription for the London *Lancet* and prevailed upon the authorities of the Case Library to accept it as the nucleus for an assemblage of medical journals.

Subscribers to the library at large, on payment of a dollar a year, were entitled to browse at will among its admirable collection of books, but the medical treatises, which soon began to accumulate, were fenced off in a wire enclosure as dangerous to the general reader. So at least it is related; and in part I know it to be true, because once as a small boy I was left outside the enclosure while my father, who had a key to the paddock, got in and became promptly absorbed in the pages of a foreign-looking book.

Left to my own scant devices, I watched the world out of a deep-seated window near-by, an occupation which enables me now to say that the paddock for medical books was in the southwest corner of the second floor of the old "Case Block," for the view commanded what was then the post-office and, beyond, the Public Square. That at all events is my recollection. Still,

I have a congenital difficulty in telling, off-hand, the points of the compass, and have no patience with people who instinctively can. To distinguish East from West, I always find it necessary to face an imaginary Lake Erie which is North, and I then know that the sun rises—no, sets—to my left down Prospect Street which must therefore be West.

There is no body of water to serve for Bostonians any such useful purpose. There is no East or West in Boston that I've ever found. The only thing to help you when lost, even if instinct warns you it's the wrong direction, is to go up-hill. You'll surely arrive, however tortuously, at the Hub of the universe where hangs a sacred cod—a place you can't use for anything except as a new point of departure. It's just like attaining the North Pole from which every direction is South.

So when a doctor feels himself lost or astray over some difficult problem, there's just one thing for him to do—to betake himself to a library, a place whence knowledge radiates, there to get a fresh start. And having got ourselves thus properly oriented, we may come back to Dr. Himes and the *Lancet* of 1878 as a point of departure.

Great benefactions grow out of similar acorns and many of them start with the gift of a handful of books. Some of our great universities have come from equally modest beginnings, books having proved a surer way of making a proper start than a gift of money. So Yale, for example, was founded:

Each member brought a number of books and presented them to the body; and laying them on the table said these words, or to this effect: "I give these books for the founding of a College in this Colony."

Books are tangible property and their sponsors must not only provide for them but make it possible for others to use them. Money gets dissipated and committees disagree as to how it had best be invested or expended. No such question arises when books are concerned; and the soul of an institution that has any pretense to learning comes to reside in its library, no less than does the soul of a profession or of an individual.

There is a peculiar thing about books, insufficiently emphasized. They are bibliotrophic, one attracting another; for books don't quarrel, only their authors. House them properly and other books will, instinctively, come to the roost. What is more, those of a kind mysteriously flock together. So around Dr. Himes' *Lancet*, other doctor-books assembled themselves. The Cuyahoga County Medical Society, by vote, added to the mischief by apportioning two-thirds of its membership dues to the purchase of more books and journals and soon the Case Library became so embarrassed by the straying of medical tomes from their proper enclosure that the interlopers were "given notice." Appeals for space having been made to the City library *without avail, the doctors were* thrown upon their own resources.

This is a nigh-invariable happening, and a very good thing 'tis so. The profession cannot long play the cuckoo with its books. It must build its own nest, and care for its own brood. A book-conscience, thereby developed, serves as the best

possible measure of the *status of the profession*. As the calorimeter tells the activity of the patient's metabolism, so may you determine the plus or minus activity of the local profession in any district by the condition of its library. And no less well may one gauge the quality of a medical school, of a hospital, of a laboratory, of the individual doctor himself, by the same standard.

I need not recall to you, who have anxiously taken them, the many steps necessary to provide properly for the collection belonging to the Cleveland profession, which had so modest a beginning. Similar steps, and not always forward ones, have been taken by the doctors in all communities the world over. For the first evidence of solidarity among our fellow-kind, wherever they are found, is the establishment of a library for use in common and from which, as an appropriate and convenient centre, there comes to radiate in due time a host of subsidiary activities. For purposes of comparison with your own experiences, as well as to show what may be in store for you, I will tell briefly the story of the one of them with which I happen to be most familiar, and to which I stand deeply obligated.

At about the time Moses Cleaveland and his party were busily surveying this then distant wilderness, some doctors in Boston, young men mostly in their twenties, organized what was known as The Medical Improvement Society. They met at each other's houses on Thursday evenings to read and discuss medical papers. Incidentally they formed what was known as a "social" library and began to collect books. These at first were deposited at the home of one of the members and subsequently in rooms over an apothecary-shop as a convenient place of meeting. By 1807, according to the first printed catalogue, the library contained 184 volumes, and these soon multiplied beyond the capacity of Apothecaries' Hall to hold them.

Temporary accommodations for the

cumbersome waif were then found in the Medical School which had just moved into new quarters; but books of the sort were not particularly welcome, and doubtless with a sigh of relief the collection, then of some 2000 volumes, was finally transferred to the shelves of a private corporation, resembling the Case Library here, which at the time of its foundation just one hundred years ago absorbed most of the lesser circulating libraries in Boston.

One thing at least was demonstrated by this move—that a general library makes a neglectful step-mother to a strictly professional foundling; and a period of nearly fifty years of inanition ensued. Various medical societies meanwhile came to be established, each with its own indifferent, variously deposited and privately owned lot of books.

This represented the status of the Boston Medical Library when in 1874 a young and energetic doctor of thirty summers, James R. Chadwick, came upon the scene. He was convinced that the several separate accumulations of medical books should become united for the benefit of the whole profession. On his initiative and at about the time Dr. Himes subscribed for that historic copy of the *Lancet*, a new society, the Boston Medical Library Association, was founded with O. W. Holmes for its first president. A librarian was appointed and some rooms engaged in which the local medical societies could hold their meetings in an atmosphere of books which some of them might be tempted to consult. Up to that time, it is said, the local profession at large read the *Boston Medical and Surgical Journal, Braithwaite's resumé* of English medical literature, and little else.

All this activity on the part of an enthusiastic and seemingly irrepressible young man, who proposed to fuse many select organizations into one and to pool their books, was doubtless very disturbing to his conservative elders. But their opposition was overcome; temporary quarters were secured; and the result? Before three years were out, the quarters proved

inadequate, and what promised to be a permanent abode was accordingly purchased.

This happened to be the former dwelling of Dr. Samuel Gridley Howe, a man who would be better known to the profession had it not been for "The Battle Hymn of the Republic" which served to obscure the visibility of Samuel Gridley in favor of Julia Ward. But the sacred spot proved to be no "permanent abode." Ere twenty years had elapsed in rooms which could with convenience hold some 5000 volumes, over 30,000 and as many indexed pamphlets had accumulated.

So the local profession dipped again into its pockets and even more effectively into those of its obliging friends. A handsome building, to serve for all time, was erected on the outskirts of the then residential district; and what amounted to an Academy of Medicine with the library as its main feature was established.

How unimaginative and myopic we are, to be sure! The 30,000 volumes transferred to the empty stacks of this carefully planned new building in 1901 have become 145,000; nor does this include the vast number of uncounted pamphlets and theses, of portraits and engravings, of manuscripts and *epistolae obscurorum medicorum*, not to mention an extraordinary numismatic collection, and historical curios and memorabilia of untold sorts—all most precious, all well catalogued, all of the utmost value and service to the profession.

And now, after a short twenty-five years, this new building, as was its humble predecessor the one-time residence of the Howes, has become so gorged with books there is scarcely standing room for the official staff, and the Library Association finds itself again at the cross-roads— "To move or not to move."

With a different setting how familiar this story would be to every community. The discussions concerning it were not intended for my youthful ears, but I can recall the founding, in the late 1880's, of a "Society of Medical Sciences" the avowed purpose of which was to develop a medical

library worthy of Cleveland's undoubted future position as a centre of culture and education.

Though the seed be sown growth is discontinuous. The right man or the right group of men to solidify and to energize the profession are not always at hand nor are their efforts permanent. With their passing the doctors again become individualized, or separate into groups or cliques. The community library gets neglected, soon becomes antiquated, and a period of indifference follows until some new spirit, by arousing their sense of responsibility in common, ties separated groups together again.

Such a turn-over comes about once in every generation. Your Prospect Street home was a monument to the activities of those here only in spirit—Allen and Rosenwasser and Milliken and Weber and Handerson—just as this present building is a monument to their self-sacrificing successors, the energetic President and the hard-working members of a most efficient building-committee, who share the gratitude of us all.

But as books crowded you out of your recent more humble quarters so will they in time from this magnificent hall. Books will like the look of this place, will come in swarms, will drive you into additions or, like the Bodleian, under ground in fifteen years, or into another and still more palatial home in thirty or less. That at least may well be your expectation and indeed your cherished hope. Without growth a library becomes a *corps inanimé;* and growth is what that forward-looking man, Dudley P. Allen, whose honored name this beautiful building carries, would certainly expect of the library he so handsomely endowed, and which should worthily represent the Cleveland profession.

The doctors' books are of a different sort from the lawyers' and the preachers'. They in their professions depend as yet largely upon authority. The doctor, ever since Galen was toppled from his dominating seat, has been skeptical of

authority and perhaps too much inclined to novelty. But if he makes any pretense of "keeping up" with the amazing, prodigious and often revolutionizing advances which, through some new discovery, occur almost overnight, he must read, or attend meetings—or better, both. And in such a dual place as this, where he may not only have easy access to the current journals but may rub elbows with his fellows and ventilate his views in the forum of the Academy, he will have the best possible chance to keep abreast of the tide of new knowledge.

Mere numbers of books, to be sure, is no measure of the usefulness and value of a professional library. Its real value depends on the completeness of its journal files and important source-books, not on text-books of ephemeral interest.

To separate the wheat from the chaff takes the knowledge and sane judgment which Charles Harding, with the moral support of that directing Chadwick of the Cleveland profession, Dr. C. A. Hamann, has shown during the past twenty-five years with all too lean an endowment. And, given a good working library rich in its books of reference, its usefulness depends on the encouragement and convenience it offers to the reader, no less than on the infectious enthusiasm and spirit of its working staff.

There was once a doctor named Richard Mead whose famous collection of some 100,000 volumes was apostrophized by Dibdin. Mead's library motto, "*Non sibi sed toti,*" which outdoes even Grolier's famous device, "*Io. Grolierii et Amicorum,*" might fittingly be adopted for the *Ex libris* of our great medical libraries. It would in any event serve to keep green the memory of Mead and of his generosity with his books. For a library must make unselfish use of its possessions even at the risk of an occasional loss. An open shelf, like an open shop, encourages the real worker who often chooses to browse for himself and should at least be put on probation. A library unexercised, and which takes no

chances in life, is susceptible to the deterioration and scleroses certain to attend a poor circulation. To be sure, with some people there is no mine and thine in the matter of books; but one must take the chance and fill in the gaps when they occur; however painful, temporarily, the loss. It's far better than not to be used at all.

The testy librarian of tradition, miserly of his treasures, near-sightedly buried in his latest acquisitions, impatient of interruption, is an extinct species. And if such persons really ever existed beyond the pages of fiction it would be charitable of us to ascribe their traits to the absent-mindedness that a most exacting task is prone to engender. You have doubtless heard how late one afternoon the college librarian started home with a friend, and finding it raining went back to get his umbrella. As he did not reappear he was sought out and found confusedly looking for the object under "U" in the library catalogue.

Few more arduous and difficult tasks confront a curator of books than that of collating and getting bound the heterogeneous medical periodicals which comprise, it is estimated, about two-thirds of the volumes in such a library as this. They vary to an incredible degree and with no seeming rhyme or reason other than the fancy of the publisher, in their form, in their make-up, in their pagination, in their dates of issuance. There are "new series" and "old series," with changes in volume-number, with changes in name, with changes in format. What was once a quarto becomes an octavo; volumes may cover irregular periods of time and have no relation to the calendar year; some use Roman numerals, some Arabic; there may be several sets of paging in the same volume; there may be separately paged supplements, serially paged advertisements and text. Journals may suddenly go out of existence with no obituary notice, or without publishing the banns they may inter-marry and reappear hyphenated, scarcely recognizable in their new alliance.

How librarians with any bibliographical conscience keep their sanity under these circumstances should be more a matter of surprise than that they should exhibit testiness when you or I, as privileged characters, walk off with an unbound issue and forget to return it. It will be a happy day for these long-suffering persons when Ostwald's *Weltformat*—the size of the *Index Medicus*—comes to be obligatory for all medical journals. "Big quartos and long heavy royal octavos were intended to be dropped (from a Pisa or Pisgah height) upon the heads of people we strongly dislike," writes a librarian who has spent much of his life assorting and shuffling and indexing unstandardized volumes which don't fit in standardized stacks.

There have been some misgivings, I am aware, as to the wisdom of placing this beautiful building so far from the beaten tracks of the practising doctor, who more than anyone else should be considered. But this is at most only a passing inconvenience, and a path to your door will soon be deeply worn by many a student and writer. Those who habitually use a library acquire that sense of attachment and obligation which impels them to bequeath to it their personal collection of books for which they wish to provide a permanent and happy home.

It was in this way that the nucleus of your historical collection came to be deposited here as the gift of that remarkable and cultured man, Dr. H. E. Handerson, your one medical historian of note—a man whose memory you will increasingly come to honor. His more-than-a-translation of Johann Hermann Baas' celebrated work held the field as the most used treatise on medical history till the appearance of Garrison's classic. Both Handerson and Baas exemplified the saying that men often do their best work in the face of, and perhaps because of, a bodily affliction. Baas stumbled upon medical history as an alluring subject wholly by accident, and humorously remarked, "In the effort to fill the immense gap in my medical educa-

tion—I fell into it." I find a letter from Dr. Handerson of April 25, 1910, in which he says:

Yes, poor Baas is dead. He was a man of unique character and of exceptional ability, handicapped for thirty years by a chronic and progressive disease of the spinal cord, which deprived him of all power of locomotion and confined him almost absolutely to his office chair.

"My correspondence with him began about 1881, when I asked his permission to translate his "Grundriss der Geschichte der Medicin," and continued without break until his death. Indeed, his wife writes me that the last letter which he was able to read was the one in which I announced my departure for the South in the effort to recover my own breaking health. No two men could be more unlike in disposition than he and I, and yet common interests and long association developed between us a friendship almost fraternal in character. I certainly feel as though, in the death of Dr. Baas, I had lost a real brother.

Yet the two had never met except through the mediation of correspondence. Could there be a better illustration of how books may serve to tie together members of our profession and bring happiness into their lives?

To inoculate a doctor with the library-habit he must be caught young and here, as I see it, you have an exceptional opportunity in being near to a growing centre of medical education. If therefore you will work for the next generation, open your stacks to the undergraduate, make him a junior member at a small fee, and let him learn where and how to find books in your reference shelves. He will in turn become your great supporter, will learn the value of books, will begin to make his own collection, which will in time come to be deposited here.

If you are to infect the young with the reading-habit, you must set the trap for them, so baited that they will walk into it unawares. Books must be made accessible. It is someone's business in every medical school to teach laboratory methods to the students but it is no one's particular business to teach them how to use medical literature, which to the majority in the long run will be infinitely more useful than an experience with smoked paper and Ludwig's drum.

Short talks on the use of the library might well be made an obligatory sectional exercise for students. Mr. Harding has given such exercises, I am aware, on methods of looking up subjects, on the use of the great indices, and so on—not always without discouragement, he relates, as when a student thus instructed requests a copy of "Ibid," saying he is sure it is just the article he needs.

But on the whole it is a wise form of self-protection for a librarian to let down the bars and permit free browsing in his pasture to those he has initiated. A few days ago on a ward visit while puzzling over a patient with ischaemic fingers and toes, I asked a student if he would get for the inspection of the class Raynaud's original thesis, and how would he go about finding it. He replied, "Ask the librarian for it." This sufficed to squelch me; but the librarian might have been otherwise engaged, and we cannot well succeed in life leaning wholly on other people.

I have always felt that a hospital or a medical school that wished to cultivate a scholarly spirit must have its library on the ground floor. A reading-habit is much less easily cultivated if a flight of steps intervenes. Some few years ago at the Harvard Medical School we had no central library worthy of the name. There were excellent departmental collections of books, to be sure, but the key was usually in the pocket of the departmental chief and the books, largely used for his selfish ends, were scarcely available to others.

We have changed all that—or have largely changed it. The most accessible room on the ground floor of our administration building had been given over in days gone by to a students' loafing- and smoking-room. Furnished with a piano

and newspapers it was much frequented. Up two flights was the students' library, comparatively-speaking unused. The reversal of these quarters was somewhat painfully accomplished, and the students now drop in to read in their spare moments and must climb stairs to smoke and gossip. It has quite unconsciously transformed their whole attitude toward Medicine.

It is futile merely to counsel the undergraduate to make use of a library, still more futile to expect him to learn the ropes of a number of different libraries in out-of-the-way places. Books must be put in his path so that he will stumble over them. This is particularly true in these days when reading as a fine art is about gone, when best sellers are sent by mail once a week for two dollars a year, when there is jazz, the movie, the radio and the flivver always at hand, with golf and bridge on Sundays: to the distraction even of his elders. No, there is only one thing to do with a young man: place both books and cigarettes in his way and caution him to beware of them as dangerous habits. He'll certainly take to one, and perhaps both.

This may after all be the right tack—to warn young people against books. Or at least against book-collecting; for one may easily become enslaved and soon so enveloped by books that they are on the floor and out in the front hall and in the dining-room till you never can find the volume you want and feel sure your wife or the children must have taken it from the place you last put it, when they borrowed your paste-pot and scissors. You long for a paddock and key like that in the old Case building. This, I take it, is just what has happened on a larger scale to the Cleveland Medical Library Association and explains this present meeting. You had become so swamped by books in your recent quarters that individual volumes could no longer be found when called for.

In fact beware of books. Some biologist has stated that if Nature could take her course unimpeded, the world would become populated with elephants wallowing about,

knee-deep in a seething mass of mice. This man knew nothing of books. As a species they are imperishable, and against their multiplication, Nature has no chance whatsoever. The time will come when every tree has been felled for paper, every calf for leather, and the few long-haired and ill-nourished people left in the world will be madly making card indices of the volumes which have filled every available cranny in which they can be stored. Laws will have been passed against their importation—only a quota of the French and German and Italian and Polish—especially Polish—books to be admitted each year. For should you happen to leave a pair of foreign books alone on a shelf in the state known as their original wrappers, they breed with astounding rapidity.

Then, too, they have their diseases and are a trouble, like too many children. They have worms; they wear out their clothing, break their backs, dislocate their joints and require the constant care of a bibliotherapeutist. I may hazard the guess that if Mr. Harding were asked what were his chief needs, he would say $10,000 a year merely to put the present unbound volumes in covers and to re-bind or re-back those which are falling to pieces. Cleveland is a place of great commercial prosperity, but the emblem of prosperity is smoke, which is no less devastating to books than to the trees which once beautified the Forest City we some of us remember.

Yes, beware of books as an expensive habit and wasters of time. The habitual "listener-in" at the radio expends no more. But for books, and second-hand catalogues of their sales, I might have done better with this address concerning them. I will give you an illustration.

There was an old patriarch named Symes, who formerly kept in the Rue des Beaux Arts a musty shop solid with dusty books leaving scarce room for his occasional customer. I once on a time bought from him a volume he evidently thought I needed. Monsieur Symes loved his books

and rarely pressed them upon you. This one happened to be the Anatomy of Loys Vassaeus published in 1553 *Cum privilegio Regis*.

Vassaeus' book I did not particularly desire as it is in bad Latin which I have small patience and less ability to read. It stood on my shelves for years alongside Lipinska's *Histoire des Femmes Médecines* —a bobbed-haired production of modern times. The inevitable happened. Ere long a small and inoffensive volume was the consequence of the liaison—a mewling octavo in pale calf—the Anatomy of Loys Vassaeus in French. Aware of my responsibility, I segregated it with its mother on a back upper shelf till it could be weaned. And now comes the waste of time.

A friend has been staying with me whose metabolism and pulse rate in the presence of other people's books run high. He grows exophthalmic with hyperbiblioism. So while you endeavor to concentrate upon your proper tasks he exclaims, "Where did you get this Dolet imprint?" holding up a vaguely remembered calf of a book in his hand. "Oh, I don't remember; someone may have left it at the door, but I always thought it came into being on the bottom shelf of that case in the corner." "Are you aware," says he, ignoring my trivialities, "that Christie only knew of one other copy?" You begin to take interest. "Perhaps someone gave it to me for Christmas. But what about Dolet? Let me see the book; it's only just grown up."

And there it was, sure enough—*A Lyon. Chez Etienne Dolet. 1543. Auec priuileige pour dix ans*. And, what is more, with two other Dolet imprints, *DES TUMEURS* and Galen's *DE LA RAISON POUR EVACUATION DE SANG* newly translated from the Latin into French by the printer—a veritable triplet.

This is enough; you are lost. The attack is on. Influenza in its abruptness is nothing to it, and days elapse before you are fit to resume your legitimate job. Your fever leads you first to Richard Copley Christie's life of the unfortunate Etienne Dolet, the

young Renaissance scholar and printer, contemporary and one-time friend of such as Erasmus and Rabelais, who lived in Lyons when Lyons was a place to live in, and who in the Place Maubert in Paris for his religious opinions, when only thirty-seven, suffered the fate of Servetus and was burned with his books. He had printed possibly eighty pamphlets, which are among the *rares rarissimes* of the collector. In one of them, when translating Plato's Dialogues and quoting Socrates on the immortality of the soul, he had added three words which left the meaning dubious and for this he went to the stake.

And this leaves you anxious to know about Christie, whose chapters, on Rabelais, on Padua, on the trial and the scene at the Place Maubert, give one a vivid picture of the time when printers issued books at the risk of their lives—Christie who worked eight years on his "Dolet" and hints in his preface at a long and continuing illness— but after all there is this address to write and much time has been lost. Beware the book.

Some doctors have the conception that a medical library is a place where someone can be found who will prepare a list of references with which to embellish their compositions. Some organizations even advertise that they will, for proper remuneration, look up the literature of a given subject so that writing may be made easy. Writing is not easy and cannot be made so by any known short cuts, and who ventures on such, even has he natural gifts of expression, is booked for a fall.

Writing comes after reading. One's ideas are, after all, merely those of others modified to suit one's own needs. And since reading and writing go hand in hand our medical libraries and libraries in general perhaps miss a great opportunity in not having an editorial desk presided over by a well-chosen sub-librarian to enlarge the scope of the medium of publication, which some, in imitation of the *Bodleian Quarterly Record*, have already started.

Should your own *Bulletin*, for example, come to include the Transactions of the local Academy and the papers presented before it, thus truly representing all the activities which focus on the Library, many advantages would accrue. The younger contributors could be coached in methods of presentation, and probably the salary of such a teaching-editor could be more than made up by the exchanges of foreign journals which must now be purchased and whose number increases by leaps and bounds. There are, I believe, some 1800 or more being issued. In our Boston Library only 570 of them are received, a few by gift and exchanges, but at least 400 of them are paid for at a cost of about $5000. The librarian tells me that he ought to have double this sum for periodical subscriptions alone.

In the days before there were community libraries, the individual doctor was a great buyer of books, to which the success of the early American publishing houses with their reprints of European treatises bear abundant testimony. I still have the annotated Boerhaave, the Motherby's Dictionary, the Commentaries of van Swieten, Cullen's "First Lines," Smellie's "Treatise," Beddoes' "Observations," and so on, that belonged to my great-grandfather, a hard-pressed country doctor, who rode through the winter snows of the Berkshires and died, young, from what was then called typhus, contracted, so it is recorded, while caring for British prisoners after the Battle of Bennington. Such books may become handed on if a medical line survives, but should it not, there is no place for them but the auction-room, unless there be somewhere a collection to which they may properly gravitate. It may be to a local doctors' club of sorts, to a department in a medical school, to a hospital or, in these modern times, to a community library such as this.

Look if you will at the written histories of the great medical libraries of the country, like that of the College of Physicians of Philadelphia with its 150,000 bound volumes and stack-room for twice as many, or that of the New York Academy of Medicine which is just now transferring its 140,000 volumes into a new building, and you will find that the leaders of the local profession in these as in other places have not only been users but collectors of books of which in time the local library has become the beneficiary.

But you cannot well afford to wait for these donations. The more precious classics of Medicine, the number of which is limited, grow more and more rare, more and more expensive, as the demand for them increases. New schools are being founded that appreciate the value of books. It is rumored that Tulane is buying, also Rochester, Detroit, Pittsburgh; and that the new Duke University plans to have a great library for its medical department. So even a school for undergraduates may enter into competition with you for books. At the Johns Hopkins they have drawn plans for a building with stack-room for half a million volumes and have appointed Dr. Welch, whose name spells success in whatever he undertakes, to fill yet another chair, as Professor of the History of Medicine. Such a post, for such a man, at such a place, indicates that progress in medical science is regarded as merely building on a knowledge of the past.

What is needed in every community is to bring the best possible collection of the books of reference he will need as near to the worker as circumstances permit, so as to save his time and energies. The recent tendency has been to lavish gifts on our laboratories and to neglect our libraries, but medicine needs both if we are to uphold our vaunted reputation of being a scholarly profession.

Some day when you have the endowment you deserve, you will come to enlarge your collection of the early treatises which the medical historian particularly needs. You may not aspire ever to rival the Philadelphia library in the possession of cradle-books, but those of the sixteenth century should be gathered in when

they turn up at reasonable prices, even though, to use an expression of Osler's, you may have to "bleed the Fellows" for the wherewithal.

Your library committee doubtless has seen other more immediately important gaps to fill, and has resisted the temptation to enlarge the historical collection of which the Handerson bequest makes but a small beginning. Nor did you rise to the fly of the Fabrica of Vesalius which was quietly cast on the pond by Howard A. Kelly, a very estimable sort of person in his way, though he has led many a librarian and many a helpless young student into a bibliophilic downfall. He and Osler, I believe, bought up every copy of Vesal's *magnum opus* that came on the market and baited libraries with them. This was bad enough, but what Dr. Kelly did to me, an individual, was worse.

My former colleague, W. G. MacCallum, many years ago brought back from abroad a copy of the 1543 "Fabrica" which he had been tempted to purchase, but conscious of the dangers of bibliomania he decided to present it to me, as a person presumably immune. I thought I was, having never collected anything more serious than postage-stamps and butterflies; but Dr. Kelly, hearing of it, promptly gave me a copy of the 1555 edition, in pigskin, with metal clasps, as it had come fresh from the press and bindery.   .

I fell. It was of course interesting to see what changes Vesal had made in the later text; and then there were other editions, posthumous ones, to be compared, and if possible possessed. Vesal had complained to the learned Oporinus, his printer, of various plagiarists of his earlier anatomical plates; these must therefore probably be of interest. And then the many other authors his copyists and imitators, and the printing-houses which issued their books; and what other medical books they printed; in turn lead you on, with a ring in your nose.

You begin to feel that you would like to know something about Vesalius the man,

and about his contemporaries, and about his life other than as an anatomist. And so whenever you chance to be abroad you follow his footsteps, and look in the galleries for his portraits, spurious and otherwise, of which there are many. Then there were other books which he published, and innumerable copyists of them, in England, in Spain, in France, in Italy, and the Low Countries whence he himself came; and you soon get into the habit of second-hand book catalogues. Ere long the unconscionable people that issue them learn of your frailties and tempt you sadly, meanwhile putting up their prices to such an extent that when the post delivers at your door a brown-paper parcel with foreign stamps on it you have to prevaricate before your family and audibly wonder who could possibly have made you the present of another old anatomical work.

Like the proverbial pebble cast into the pool with its ever-widening circles, just so, one may start with a single book written by a single person from which the history of the world may seem to radiate. There are of course limits to this as to any hobby if you're not cautious, but as a form of relaxation for a tired and often harassed doctor it beats golf or bridge and all out-doors together.

Its a far cry from the few personal books in the study of the individual doctor to the great national collection under the direction of the Surgeon-General of the Army the very mention of which should bring to mind the name of John Shaw Billings. His vision and industry, more than that of any other person, and purely through the medium of books, has given the American profession the tool essential to its advancement—a classified catalogue of all medical literature. It was this monumental Index which brought into existence the great medical libraries, like your own, for without it they could hardly be utilized.

But no local library, however rich the community, can aspire to anything comparable to the vast collection in that treasure-house at Washington. If you

should wish to know how books breed books and would take due warning therefrom, place beside the existing 42 volumes of the Index Catalogue with their two million or more listed titles—place beside these heavy green-covered quartos the wee volume printed on October 23, 1865, with its 599 titles, which represents all that Dr. Billings had for a nest-egg. They were mostly the Systems and text-books of the early 19th century, the medical classics being represented merely by the publications of the New and Old Sydenham Societies. The oldest actual publication was Verheyen's Anatomy of 1717. Compare this humble start, with a library which now contains nearly 500 incunabula among its 350,000 volumes and as many unbound pamphlets.

And as this is the "last word" in medical libraries, it may properly be the last thing to mention in an address about the doctor and his special books—an address which, simmered down, says nothing more than has always been said, that books are the most important tools of our craft when assembled in mass in our great medical libraries; that books no less may be to the individual doctor his greatest source of relaxation, his greatest solace in times of trouble, when near to his hand on his own shelves.

We have come here in a spirit of thankfulness to those in and out of the profession who have given so generously of their time, so generously of their money, as to make this superb library building what it is. But it must be something more than a mere symbol. Cleveland is looked upon as one of the most prosperous and forward-looking of our greater American cities. She cannot afford to risk her reputation on her leadership in commerce and manufacture alone. She is in a position to compete for leadership in the arts and professions.

Since this Cleveland Medical Library Association, as I understand it, stands in the place of the landlord to the Academy every self-respecting Cleveland physician should be a member of both. We shall see,

ere long, in this immediate vicinity one of the great medical centres of the country. It will need vision; it will need loyalty; it will need money. Where there is vision and enthusiasm the rest will follow. Your part of this task is to see that one of the great medical libraries is gathered here, abounding in works of historical and theoretical no less than in works of immediately practical value, for without this your local profession will be greatly disadvantaged. The Academy, with which you are affiliated, with prudence will come in time to be the arbiter of all matters relating to health, hygiene and sanitation, which are such vital factors in community welfare. These are great responsibilities. But the country has learned that Cleveland is a city that eagerly rises to responsibilities and that her citizens are more prone to drive the car of progress than they are to follow in its wake.

BOOK REVIEWS

PLASTIC SURGERY OF THE ORBIT. By J. Eastman Sheehan, M.D., F.A.C.S. Professor of Plastic Surgery, New York Post-Graduate Medical School and Hospital; Associate Surgeon and Lecturer to the International Clinic of Otorhinolaryngology and Faciomaxillary Surgery, Paris, etc. With a Preface by Pierre Sebileau, Professeur de la Faculté de Médecine de Paris. Pp. 348; illus. Macmillan Co., N. Y. 1927.

The late war brought to a high degree of excellence a new school of plastic surgeons. Until recent years plastic surgery was classed as a thing which beautified aging women and gentlemen born with unpleasant appearing noses. There are still those who flourish by courting the vain and unsuspecting; but, on the other hand, there has grown into being a type of surgeon who is doing both wonderful and much needed plastic work. It is surgery involved and calling for skill in one trained in the fundamentals of the surgical art, a field no neophyte need attempt.

Dr. Sheehan's book is therefore welcome. It is well written, printed in large type, profusely illustrated and in length 348 pages.

The first part deals with anatomy and physiology; Part 2 with preparation, after care,

skin grafts, surgical conditions; while Part 3 deals with operative procedures. In Appendix A is an article on anesthesia by I. W. Magill, M.B., B.CH., B.A.O., of Queen's University, Belfast, while in Appendix B the book closes with a consideration by the author of the evil results of paraffin injection.

DISEASES OF THE MOUTH. By Sterling V. Mead, D.D.S. Prof. Oral Surgery and Diseases of Mouth, Georgetown Dental School; Prof. Diseases of Mouth, Georgetown Medical School; Oral Surgeon to Georgetown Hospital; Dental Surgeon to Providence Hospital, etc. $10. Pp. 578; 274 illus. 29 col. pl. C. V. Mosby Co., St. Louis, 1927.

This excellent book is well worth while to both surgeon and internist, and is well written. The publisher has also done his part in making the book good to feel and look at.

Dr. Mead begins with a consideration of the Oral Examination and then covers the field of Radiograms, Diagnosis of Pulp Vitality, Trans-illumination of the Teeth and Gums, Bacteriologic Examination, Disorders of Enamel, Dentin and Cementum, Dentition, Abnormalities of the Teeth, Malocculsion, Saliva, Dental Calculus and Accretions upon the Teeth, Localization of Unerupted Teeth, Impacted Teeth and Foreign Bodies, Impacted and Unerupted Teeth, Periodental Diseases, Diseases of the Dental Pulp, Periapical Diseases of the Teeth, Pulpless Teeth, Specific Infectious Diseases, Infections of the Floor of the Mouth and of the Neck, Diseases of the Blood and Blood Vessels, Diseases of the Nerves, Diseases of the Lip, Diseases of the Tongue, Diseases of the Throat, of the Salivary Glands and Their Ducts, of the Maxillary Sinus, Congenital Clefts of the Lip and Palate, Stomatitis (done in a most thorough manner), Diseases and Disorders of the Mandibular Joint, Diseases and Injuries of the Maxillary Bones, Fracture, Tumors, Cysts, Temperatures, and Relationship of Oral Sepsis and Systemic Disturbances.

While many physicians will read this work with profit, it is hoped that its distribution will be a large one among dentists also.

DEMONSTRATIONS OF PHYSICAL SIGNS IN CLINICAL SURGERY. By Hamilton Bailey, F.R.C.S. (Eng.), Surgeon, Dudley Road Hospital, Birmingham; late Honorary Assistant Surgeon, Surgical Registrar and Tutor, Liver-pool Royal Infirmary; Surgical Registrar and First Assistant, London Hospital; etc. $6.50. Pp. 234; 261 illus., some col. William Wood & Co., N. Y., 1927.

As a rule a reviewer of books reads only parts of the work before him. He is most interested in the table of contents, the index, and the general make-up of the volume. He may read a chapter here and there, glance and scan page after page, and so get a hazy, general idea as to whether or not the book is good, very good, bad, or just terrible. If it is very good or very terrible he delves deeper into the pages open before him. Though mediocrity simply bores—the extremes fascinate.

This work of Hamilton Bailey is of such merit generally that the reviewer read it "from cover to cover."

In the first chapter, the author begins with an outline of the seven stages necessary to a surgical diagnosis. After enumerating them he says, "The seven stages may be termed the 'surgical crescendo.' It is with the second stage [the elicitation of physical signs] and the latter part of the fourth [a differential diagnosis, through a mental process largely of exclusion, but reinforced when possible by further physical signs] that this book is entirely concerned."

It is a book recommended to every senior student in medicine. Every surgeon might well idle through its pages. It covers a familiar field in a well-rounded style and enriches one's scientific knowledge. In many ways its general style reminded us of Cabot's "Physical Diagnosis" . . . and this is praise, indeed.

LEHRBUCH DER OPERATIVE GEBURTSHILFE FÜR ÄRZTE UND STUDIERENDE. Von Professor Dr. Georg Winter, emer. Direktor der Universitäts-Frauenklinik in Königsberg in Pr. Unter Metwirkung von Prof. Dr. W. Benthin, Priv.-Doz. Dr. H. Naujoks. Berlin: Urban & Schwarzenberg, 1927.

Professor Winter is known to every English speaking obstetrician. It is another example of a man's reputation and fame for outdistancing the man himself.

In this splendidly printed and illustrated book of 475 pages on operative obstetrics, Professor Winter has not offered anything new, so much as correlated and presented his subject in an orderly, logical and interesting manner. Unless one reads German all this is lost. But, at that, we suggest that the teacher and

obstetrical specialist procure this volume for the illustrations, if for no other reason. The black and white and colored pictures are of a high order and cover the field of operative obstetrics. Even though one cannot read the text, he can derive no end of ideas and information from the plates.

THE "WELLCOME" PHOTOGRAPHIC EXPOSURE CALCULATOR, HANDBOOK AND DIARY, 1928. Burroughs Wellcome & Co.   N. Y. 1928.

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The American Journal of Surgery

EDITOR: THURSTON SCOTT WELTON, M.D., F.A.C.S., NEW YORK

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The American Journal of Surgery

CONTENTS—FEBRUARY, 1928

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1. SMITH, J. J. The surgical treatment of diverticulitis of the sigmoid. *J. Am. M. Ass.*, Chicago, 1922, lxxv, 382–388.

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The American Journal of Surgery

CONTENTS—FEBRUARY, 1928

Continued from page i

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PHYSICAL AGENTS IN THE TREATMENT OF
BLADDER TUMORS*

Edwin Beer, m.d.

Surgical Service, Mt. Sinai Hospital

NEW YORK

FOR one who has lived through the last twenty-five years and experienced the progressive changes in the treatment of bladder neoplasms, a review of this sort should be a pleasurable activity. Much, however, remains to be done before we can feel fully satisfied with our progress and our results. At the beginning of this century, the general attitude towards the radical cure of tumors of the bladder was pessimistic, if not hopeless. How different the present attitude! How many changes have been effected by the introduction of new physical agents and new technique in the handling of these serious conditions. Instead of advising "Hands off!" or drainage of urine by nephrostomies into the loin, we now go right ahead, at times perhaps treading ground which is better avoided, and yet often succeed where failure used to be the rule. In all new fields of therapy—and the cure of neoplasms of the bladder may be considered new, even though attempts of the kind have been made for many years—as new methods become available, one is liable to go too far and attempt too much, at times bringing adequate methods into disrepute. Moreover, owing to errors in judgment, one may expect of newer and untried methods more than they can accomplish, and in attempting the impossible, sad failures naturally take the place of the expected successes.

Owing to the newness of the subject, owing to the fact that we are all in a stage of experimenting, it is very difficult to make use of the cases operated upon in other clinics, as would be necessary if we were to give a broad cross-section of the methods and results in all the large clinics. It seems safer and wiser to present our own experience, based on the work of the head of the clinic and of his associates who follow rather closely in his footsteps, for the methods of attack which have slowly crystallized are pursued by all members of the staff. Naturally, we are all indebted to the work of other clinics, and suggestions, modifications, etc., are continually inducing us to make changes in details which probably would not be effected but for the constant interchange of viewpoints and ideas in meetings and through the medical press. In gathering these 418 cases for this analysis, I am indebted to my associates, Drs. Hyman, Ashner, Edelman and Mann. We have all followed much the same technique in treating bladder tumors, and the uniformity of approach to the problem gives perhaps some added weight to the conclusions.

* Read before the International Urological Congress at Brussels on August 4, 1927.

In considering the physical agents that we employ in the treatment of bladder tumors, I shall limit myself to the following:

1. The treatment of benign papillomata with the high frequency currents used through the cystoscope
   A. Monopolar
   B. Bipolar
2. The treatment of benign papillomata by noncystoscopic methods
   A. Paquelin cautery
   B. Electric cautery
   C. High frequency current
      (1) Diathermy (bipolar)
      (2) Radiotherm knife
   D. Alcohol to prevent implants
3. The use of radium both through the cystoscope and through a suprapubic cystostomy
4. The use of deep roentgen-ray

I. THE TREATMENT OF BENIGN PAPILLOMATA WITH HIGH FREQUENCY CURRENTS USED THROUGH THE CYSTOSCOPE

In 1910 I called attention to the use of the high frequency currents in the treatment of growths of the bladder. I had used the monopolar current for the destruction of warts on the skin, and it seemed to me that with a properly insulated electrode it might be possible to use this current through a cystoscope and under water. While contemplating this problem, I was assured by an expert electrical manufacturer that such currents would burn out my cystoscope; but as soon as I tried a well-insulated copper electrode on skin warts under water through the cystoscope, I found that the instrument did not suffer and that the warts were destroyed. I derived my monopolar current from an old roentgen-ray machine, which I have used together with more modern ones up to the present day.

It is scarcely necessary to describe here a machine for the production of the Oudin (monopolar) and the D'Arsonval (bipolar) high frequency currents. It is, however, appropriate to call attention to the effects of these two currents so as to emphasize the differences that exist between them. In brief, the potential of the Oudin is high, while that of the D'Arsonval is much lower; in contrast, the amperage of the latter is higher than that of the former. It is of interest to study the effects of these currents both inside and outside the body. If one shapes a piece of raw beef so that there is a base, and attached to this by a pedicle a smaller mass of beef, one simulates the gross anatomy of a pedunculated vesical growth. With one flat electrode at the base and the other pointed electrode touching any spot on the surface with adequate current (D'Arsonval), one will find that there is destruction of tissue under the small electrode, and at a distance in the pedicle there is a concentration of the current which in a few moments coagulates this isthmus.

A. MONOPOLAR. With the monopolar current, similar and more extensive local effects are produced under the electrode, but the distant effect in the isthmus is less active. Inside the bladder filled with water, with the monopolar current one sees this distant action in the blanching of large branches of the tumor more often than with the bipolar current, because the monopolar current attaches the growth to the electrode more readily and by doing so allows of raising the growth and making it, in part or in toto, more definitely pedunculated. The innumerable contacts with the bladder wall being broken, the current concentrates in the isthmus and coagulates its structures.

B. BIPOLAR. As the bipolar current fails to produce this firm attachment between itself and the fronds, one does not get this ideal distant effect as regularly. Still, everyone who has had considerable experience has undoubtedly seen this phenomenon even when using the bipolar current, as evidenced by finding on re-cystoscopy a massive necrosis which was not evident when the previous treatment had been concluded. On the other hand, in the open bladder one gets this effect regularly with the bipolar current, and one can demonstrate it as readily here as on the raw beef without even putting the electrode into the bladder. If the tumor is seized with a

blunt ring forceps and raised so that its fronds are fairly free from contact with the bladder wall, which is well retracted, one can shoot the current through this forceps by touching the latter with the electrode; the forceps are held in one hand the electrode in the other, and in a few seconds one sees the pedicle blanch, smoke, and in a moment it is burnt through completely.

ing a match to it, get the typical explosion of hydrogen gas.

DANGERS

With the introduction of such powerful electric currents within the bladder, one might expect some serious accidents in the treatment of bladder tumors. Fortunately, such have rarely occurred. As the treat-
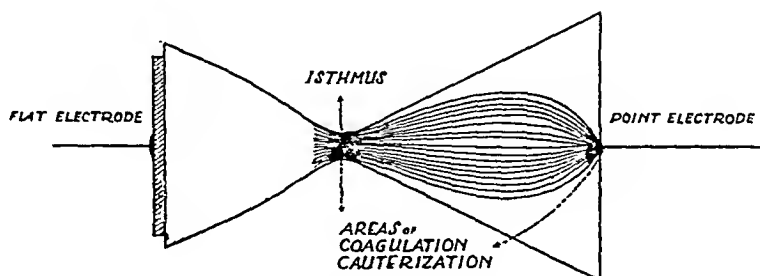
Fig. 1. Illustrating the distant effect of the bipolar current.

The bladder wall adjacent to the pedicle is moderately charred in this process.

These observations have led me for years to strive to have a grasping forceps electrode made for use through the cystoscope, so that at one or two sittings one could destroy a growth in toto by seizing it at any spot, raising it from the bladder wall, and then by shooting the current through, destroy its pedicle and vascular supply in a few moments. As yet, all the electrical technicians who have essayed to make such a seizing electric forceps with a flexible shaft have been unsuccessful. When this goal is reached, the bipolar current will have definitely gained the ascendency over the monopolar current in the treatment of benign papillomata that are accessible through the cystoscope.

Intravesically, the monopolar current, by virtue of its higher potential, has the effect of shooting away fragments of the growth, which effect is much less with the bipolar current. While the currents are playing, gas is generated, apparently hydrogen, as every once in a while, particularly if one is treating a neoplasm in the anterior wall, the gas is heard to explode. Outside the body, one can collect this gas over treated beef in a test tube, and by touch-

ment requires no anesthesia, it is inconceivable that the viscus can be perforated, for the patient complains of pain as soon as the healthy bladder wall is touched. This is an excellent guide for the operator. Occasionally after the treatment, as the slough separates, a troublesome hemorrhage occurs which is, however, readily controlled by a second application of the
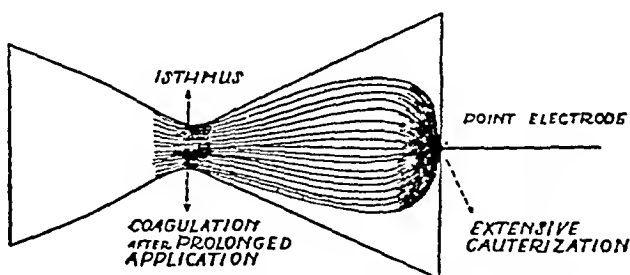
Fig. 2. Illustrating the effect of the Oudin current.

current or by the use of an indwelling catheter in the severer bleedings. This, in my experience, has been a very unusual complication.

Perhaps the greatest danger lies in the fact that the treatment is so easily carried out that many unsuitable or malignant cases are treated in this way for months, when they should have been subjected to operation if they were to have any chance

of a permanent cure. Only the rarest case of malignant papillary carcinoma is cured by this treatment, and if one fails to get the typical response, the rapid melting away of the growth, one should abandon this method of treatment for the surgical approach.

As previously mentioned, one occasionally hears a mild detonation of the hydrogen gas within the bladder, but as far as my experience goes, this has never produced the result recently reported by Cassuto[1]

In employing the bipolar current, the flat-plate electrode is placed under the buttocks and flexible, well-insulated electrodes are used through the catheterizing cystoscope. If the monopolar current is used, we employ heavily insulated cable which is infinitely better than our older electrodes, as its insulation does not melt readily and it rarely has to be trimmed down during the seance. We are still somewhat partial to the monopolar current for the reasons set forth above, but there is no doubt that
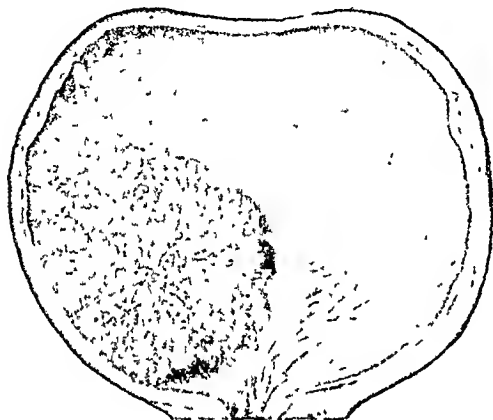
FIG. 3.
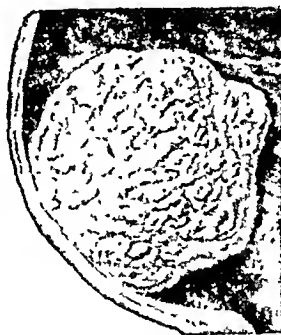
FIG. 4.

FIG. 5.

Sketch of bladder papilloma: first case treated after total necrosis of surface. Mrs. J. S., aged eighty-six. Attacks of hematuria since 1908. Treated with high frequency current in 1910. Twelve cystoscopies during the four years showed a normal bladder. Patient lived until 1919, when she developed a cardiac weakness and died. Figure 3 shows the papilloma. Figure 4 shows apparent necrosis following treatment. Figure 5 shows the small necrotic area still attached in front of right ureter meatus and small flat area behind right ureter meatus; the latter coagulated and was completely destroyed; the former was broken away with the electrode and coagulated.

and torn the mucosa of the bladder. Over-treatment of a benign growth produces an edematous solid-looking mass in the bladder wall which closely resembles an infiltrating carcinoma, and it requires great cystoscopic experience to recognize this peculiar reaction especially when it is very extensive.

Another rare accident is burning or shocking the patient by the electric current. With properly insulated cables, this should never happen, and with the electrodes now available one does not see this accident.

TECHNIQUE

Having discussed the possible dangers and accidents, it is not out of place to say a few words about the method that we use.

both currents effect the same results with almost equal satisfaction, though perhaps less quickly.

At the first session, with the unanesthetized bladder filled with water, the growth is thoroughly cauterized, the electrode being introduced into the fronds at numerous places and the current turned on with the foot switch. If the pedicle can be approached with the electrode, all the better, as a more massive necrosis will follow. If, however, this is not possible, one should try to get the electrode to adhere to one or more of the fronds at the first application of the current, and then by manipulating the Albarran finger, attempt to raise the growth on its pedicle as one turns on the current again. This maneuver may,

if successful, produce a massive coagulation in or about the vascular stem so that one is astounded at the next examination to see how extensively the growth has been destroyed.

At the first examination one can usually recover a specimen attached to the electrode or floating in the irrigating fluid (water) for microscopic study. If one fails to get a specimen in this way, one should use a rongeur or biting forceps to procure a specimen, as it is very frequently useful in deciding on the future treatment.

The endurance of the operator as well as that of the patient places a time limit on the length of each treatment, which usually lasts from ten to fifteen minutes. As it takes from one to two weeks for the dead tissue to separate, it is wise to wait a week or so before beginning the second seance. Small soft benign growths melt away so rapidly that they are completely destroyed in one treatment, and if the monopolar disruptive force has been used, the base is exposed and the wall of the bladder can be cauterized. This is less often seen with the bipolar current. Even in small growths one must wait for the sloughs to separate and cauterize the base at the second or some later sitting. At the second sitting one sees that a more or less complete destruction has been effected, and if the tumor has responded and is definitely smaller, and the microscope has confirmed the cystoscopic diagnosis of benign papilloma, one should proceed with this therapy. If at the second or subsequent seances one fails to see the definite destruction of the growth, and further microscopic studies show atypical cell growth, one should be on guard lest one is dealing with a malignant tumor. As Dr. F. S. Mandlebaum, our late pathologist, has said, wherever the usual orderly arrangement of cells and connective tissue stroma is seen with nothing atypical in either, the diagnosis of a benign papilloma must be made. If, however, the relationship between cells and stroma is disturbed or lost, if the cells are atypical in size and shape, and show variations in staining

reactions, with or without proliferation into the stroma, a tentative diagnosis of carcinoma should be made, and this diagnosis can usually be corroborated after complete removal of the growth.

After the growth has been destroyed, the small soft scar left in the bladder mucosa is often hard to locate. The heavy scars that Heitz-Boyer* speaks of are not seen in properly treated cases, though one does see them in over-treated cases, whether the monopolar or bipolar current is employed.

DIAGNOSIS

SUITABLE AND UNSUITABLE CASES

There is no doubt that the well-trained cystoscopist can usually interpret the picture and differentiate between a definitely benign and a definitely solid malignant growth. But in between these two

* Heitz-Boyer's numerous publications have somewhat obscured a very simple method. I am glad to see in his recent paper before the iii. Congress of Italian Urologists that he has announced that he now destroys the growth with electrocoagulation and then applies the monopolar current to the base so as to get soft smooth scars, which we are all accustomed to see. As far as Heitz-Boyer's contributions to this subject are concerned, I have again reviewed all his publications and fail to comprehend why he makes this simple procedure so unnecessarily mysterious and difficult to understand. In America some of us spoke of the high frequency treatment as "sparking," translated into French as étincelage, long before he ever took up the method in[2] 1911. It was my object to introduce a really simple and effective method which could be used by the ordinary cystoscopist through the ordinary cystoscope. The modification that Heitz-Boyer suggests requires a totally new cystoscope, new and special electrodes, and differs, as his French colleagues (Legueu, Papin and others) have observed, in none of the essentials from the original method. He claims he gets no thermic action from his very high tension current, but in another passage he speaks of the growths as being "escarifié"[1] by the current. Perhaps his current has a higher tension than that employed by others, but that the sparks are cold can be easily disproved by applying the electrode to one's own skin and holding it from 1 to 2 mm. away, as Heitz-Boyer tries to do in the bladder. In his 1913 paper in the Journal d'Urologie he speaks of sparking "à distance" (!), though he advocates pushing the growth out of the way with the electrode so as to cut through the pedicle. From all this it would appear to me that the so-called modification is, in all essentials, the technique originally described in 1910; and judging from the paper referred to at the beginning of this footnote, Heitz-Boyer has gradually come round to this viewpoint himself.

extremes, there are all sorts of pitfalls, and I believe we all make mistakes in interpretation, some of which may be fatal to our patients. This decision is absolutely essential, as one is not justified in using the high frequency currents except in benign papillomata, as I have always insisted. When inflammation is present in the bladder, it may be most difficult to interpret the picture. In addition to the rather typical

growths one at times obtains most varied pictures in different parts of the growth.

While it is generally granted that a papilloma with delicate waving fronds, grey-pink in color, attached to the normal bladder wall by a narrow pedicle, is almost invariably a benign tumor and will respond to the high frequency current, nevertheless from time to time one sees such a delicate papilloma apparently responding | but
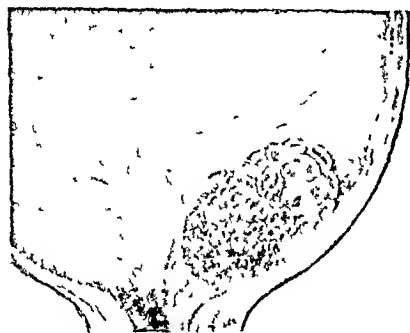
FIG. 6.
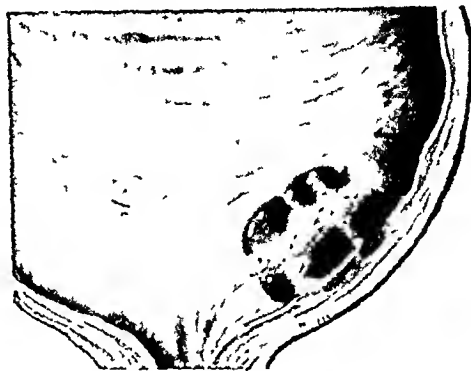
FIG. 7.

Bladder papilloma. Mrs. E. C., aged seventy-one. Attacks of hematuria for fifteen years. Treated with high frequency current in 1910. Figure 6 shows an edematous, rather solid-looking papillary growth. This was rapidly destroyed and apparently overtreated, as seen in the peculiar reaction shown in Figure 7, where the base resembled a malignant thickening of the bladder wall. Linear cauterization of this area showed it was firm and sensitive. Shortly after this treatment this reaction in the bladder wall disappeared, and thirteen control cystoscopies during six years showed a normal bladder.

picture presented by a benign papilloma, our two greatest aids are found in the study of the response of the growth to the treatment and the microscopic study of specimens removed from the growth. Rapid and satisfactory melting away of the growth usually means a benign process, although occasionally one sees this in papillary carcinomata. Absence of response almost invariably means malignancy. Microscopic study of specimens will also prove helpful if one has an experienced pathologist at hand. Whether the classification of Broders,[3] based on the cell differentiation which allows him to subdivide all these growths into four groups varying from those of mild malignancy to the very malignant, will be generally accepted is open to some doubt. These diagnoses are often based on small fragments of the tumor and it is notorious that in serial sections of bladder

sprouting always anew between treatments; and eventually at operation one finds one has been absolutely mistaken and the apparently benign growth is only a papillary excrescence in the mucosa overlying a diffusely infiltrating carcinoma. Sessile papillary growths with thick fronds or with fronds that have grown together, giving a more solid appearance, are often benign and can be readily destroyed with the high frequency current. On the other hand, similar growths in which some of the fronds are necrotic are very suggestive of papillary carcinomata, and the microscope will often decide the question so that the failure of the high frequency treatment to accomplish a cure will lead the surgeon to the proper surgical procedure. Occasionally some of these cases may respond to the current more rapidly if exposed to radium (applicator or seeds,) but how fre-

quently this happens, how much is the result of the high frequency current and how much is the result of the radiation is difficult to evaluate. Young has been most enthusiastic for this combination, and further work may convince all of us of the correctness of his views. When the tumor is partly papillary and partly solid, or when the adjacent bladder wall is thickened and edematous in the cystoscopic picture, as

extensive papillomatosis, also, either primary or secondary to a previous operation, are often very difficult and tedious to cure, both for the patient and surgeon. In addition, one does encounter patients who are so intolerant, for one reason or another, that one cannot get a fair chance to use the method under discussion. All these groups, together with the malignant cases, should have a more radical attack and their

Fig. 8. Wide extraperitoneal suprapubic exposure of bladder in moderate Trendelenburg position after irrigation and emptying of organ.

well as by rectal or vaginal touch,* the diagnosis of malignancy is almost certain; but even here it is worth while having microscopic control so that the attack can be planned with absolute certainty.

Having excluded as unsuitable all the above cases that do not conform to the benign group, we still have a considerable number of definitely benign papillomata which cannot be readily treated transurethrally with the current. I have found that tumors surrounding the sphincter, as well as tumors near the sphincter that bleed profusely so that one cannot work intelligently, are very difficult to cure definitively and are better off if operated upon. Cases of

growths should be destroyed through the open bladder, using the bipolar current as a cautery, resection if possible, radium seed implantation if non-resectable, or at times total cystectomy.

RESULTS

After a bladder tumor has been destroyed by the use of the high frequency currents, duty to the patient is by no means finished. All cases should be regularly controlled by cystoscopic examinations, at first in three months, then in six months, and finally each year for several years; for one of the strange peculiarities of bladder papillomata is their tendency to recur in a new site in the bladder, with a tumor springing up de novo perhaps years after the original growths have been destroyed. Moreover, it

* Cystograms may also be of use in showing the deformation of the bladder wall as well as the size of the growths.

is no rarity to see the character of these new tumors varying greatly in degree of malignancy from the original growth. Incompletely destroyed tumors recur in situ, but the type of recurrence just referred to, probably the result of the irritation that led to the first tumor, is in every sense a new tumor rather than a recurrence in the usual sense. Most recurrences or "recidives," are the result of growth of cells have remained perfectly well, the largest number of cases have withdrawn from cystoscopic observation after one or two cystoscopies which showed a normal bladder.* To class such cases as cured is stretching a point, for everyone who has had much experience in this field has seen such normal bladders present years afterward either a benign papilloma or a carcinoma at the same or in a different site. The original
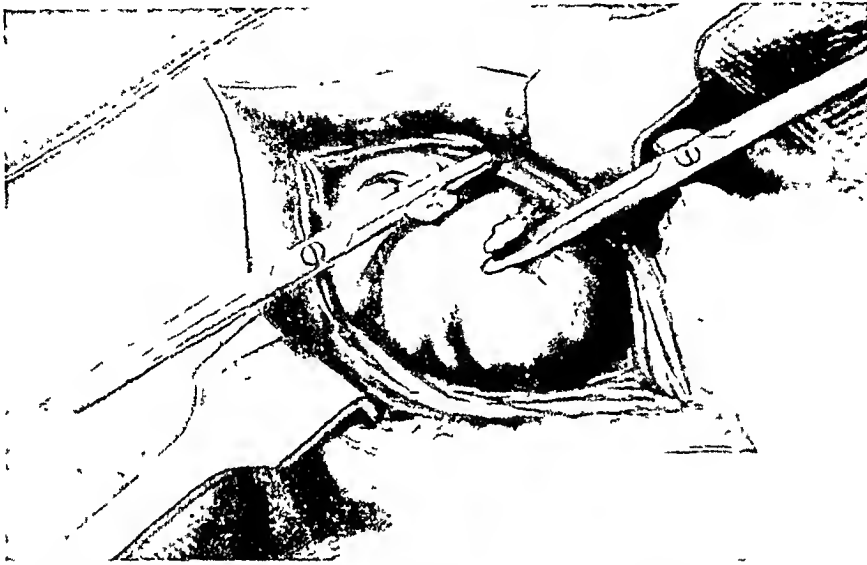
FIG. 9. Liberation of bladder from its bed. Division of the urachus. Bladder pulled out of abdomen.

that have been overlooked and not destroyed, whereas both the benign and malignant "new" tumors just referred to have nothing to do with the original growth, except in so far as they are apparently the result of the same causation. If patients are not regularly controlled they are exposed to these serious dangers and, strange to say, no matter how often one emphasizes the importance of this control, patients, even physicians who are patients, refuse to submit to this wise precautionary measure. As the result of this attitude, though we have treated many hundreds of tumors of the benign type in a large number of patients with the high frequency currents through the cystoscope, we cannot give a fair statistical statement of the end-results. While we have patients that were controlled for fifteen years by cystoscopy and growth may have been destroyed but the bladder condition was not controlled if new tumors developed within the viscus.

This attitude of the patient, this peculiarity of the bladder in producing new tumors must be borne in mind in considering a statistical study. Statistics may tell the truth, but in view of the attitude of patients we cannot furnish anything approaching an ideal tabulation. We do know precisely, however, that we can definitely destroy the original benign growths with these currents and that, with adequate cooperation, the benign recurrences in new sites can be equally well controlled.

In all we have records of 158 patients

* No matter how careful one is, a tiny bud of tissue may be overlooked and later a tumor of some size may be found at the old site.

treated with the high frequency currents through the cystoscope, representing over 200 tumors. When the treatment was new, we used considerable persuasion to make the patients submit to re-cystoscopies so that we could determine fairly definitely what this therapy offered; but as time went on, this effort could not be sustained and multiple controls became less frequent. It is of interest in this connection to note that

TABLE I

SUMMARY OF 158 CASES OF BENIGN PAPILLOMATA TREATED THROUGH THE CYSTOSCOPE

89 cases controlled by cystoscopy and apparently cured.

23 recurrences.

Papillomata treated with the high frequency current, well as controlled by cystoscopy:

Year.......	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of cases	41	16	10	7	3	6	1	1	1	2	...	...	..	..	1

FIG. 10.

Figures 10 to 17 illustrate the method or technique used in the treatment of bladder tumors by open operation.

the first 4 cases treated by this method had 7 to 13 control cystoscopies after their original tumors had been destroyed, and some were controlled in this way fifteen years after destruction of the papilloma without showing any recurrence. The fact that a patient is alive and symptom-free years after destruction of a growth, of course, is no evidence that the bladder is free, as I have seen some very large tumors (primary) that gave none of the classical symptoms of papilloma of the bladder. In the above series, numerous patients belong in this category but are disregarded in our analysis. Of 158 cases, 89 have been reexamined in the first year up to the fifteenth year, as shown on the table, and found free from local recurrence or new tumors. Twenty-three more have been

re-cystoscoped and have had local recurrences, or more often recurrences in a new site either papillomatous (8) or carcinomatous (15). Some have shown new benign tumors as late as the ninth year after destruction of the original growth as controlled by repeated cystoscopies, and some have shown carcinomata as late as the seventh year after destruction of the benign growth. This accounts for only 112 cases out of a total of 158 cases. Of the 46 uncontrolled cases, some are apparently well according to letters received, others have been lost sight of, and some of these have, undoubtedly, developed recurrences benign or malignant, whereas others have died of intercurrent maladies, coronary disease, pneumonia, etc., without having any further bladder symptoms.

From the above analysis it would seem that under the present conditions we must expect about 20 per cent recurrences of growths either in the old or in new sites in the badder if the disease once gets a footing in this organ. Naturally, if incompletely treated, the recurrences in the original site will be regularly found and will be much more frequent than those in new sites. Experience, I believe, has shown very

reached and destroyed, and growths in intolerant patients, usually demand more radical operative procedures. In 33 cases we have had to resort to the operative treatment, using the technique to be described shortly.

PAQUELIN CAUTERY, ELECTRIC CAUTERY AND HIGH FREQUENCY CURRENT. During these suprapubic exposures of the neoplasm, the physical agent used to destroy
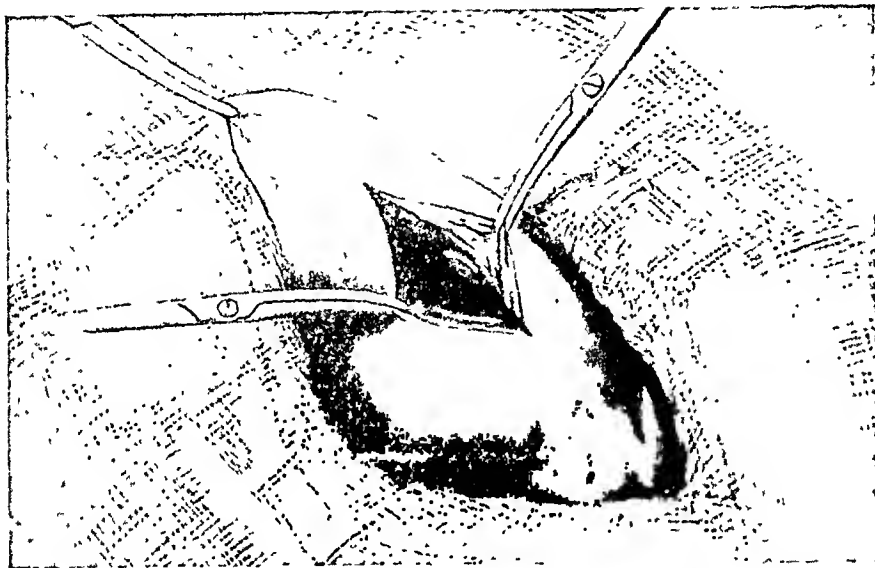
FIG. 11.

clearly that this latter type of recurrence in situ can be avoided by adequate treatment but, as yet, we have no way to control the other type of recurrence in a new part of the bladder, except by using the utmost vigilance and persuading patients to submit to regular re-cystoscopies.

2. THE TREATMENT OF BENIGN PAPILLO-
MATA BY NON-CYSTOSCOPIC METHODS

Realizing that all benign papillomata are not amenable to the transcystoscopic or transurethral method of approach, it became necessary to develop a method of treatment for this type of case. Most papillomatoses, especially those so frequently resulting from a previous operation that has spread the disease far and wide on the bladder mucosa, growths about the sphincter that bleed or that cannot be readily

the growths was heat as generated by the Paquelin cautery; but improvements led to the substitution of the electric cautery, and this again gave way to the use of the high frequency currents through the open bladder. With the bipolar current used in this way, we have a most efficient method of destroying these growths, coagulating the small growths in situ by touching the ball electrode to them, or, if larger and pedunculated, by seizing them with a blunt ring clamp and touching the electrode to the clamp as the growth is raised from the bladder wall on its pedicle. Here the distant action of the bipolar current becomes very evident, large pieces if not all of the growth rapidly come away, allowing the base to be thoroughly coagulated with this current. If the growths are very numerous, use may be made of the so-

called radio-knife or needle to cut them off electrically through their pedicles. This employs a new modality of high frequency current with over one million oscillations. This current concentrating at a needle point, very much like the de Forest needle with which I experimented in 1908, cuts through tissue with the ease of a scalpel and usually closes the small vessels. With a hooked or curved needle one can rapidly

free and might grow into tumors. I have seen patients suffering from recurrent papillomata after repeated suprapubic operations submit to the above type of operation for general papillomatosis of the bladder and become completely cured and well, controlled by cystoscopy for years after the last operation.

Judging from the controlled cases, it would seem that the chance of cure in these
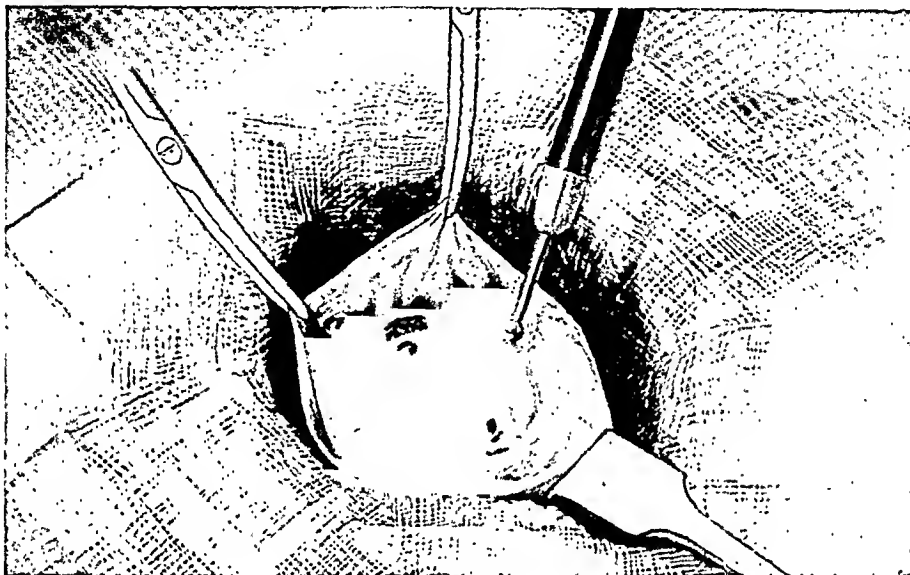
Fig. 12.

cut through the papillomatous pedicle by raising the growths and slipping the needle against the pedicle. Then the exposed pedicle can be coagulated with the ball electrode by throwing the coagulating current into the electrode.

ALCOHOL TO PREVENT IMPLANTS. After the bladder has been completely cleared of all evidences of growth, it has seemed to me that, knowing the tendency of these tumor cells to implant themselves on raw surfaces and to produce recurrences, our duty is not finished. To prevent these potential implants, I have for years soaked the bladder and the whole wound with strong alcohol for five minutes before sewing up, and I have the very distinct impression that this is effective, together with the other measures used, in physically destroying any loose cells that might be floating

TABLE II

SUMMARY OF 33 CASES WITH BENIGN PAPILLOMA OR PAPILLOMATOSIS TREATED BY OPEN OPERATION. SUPRAPUBIC CYSTOTOMY WITH HIGH FREQUENCY CAUTERIZATION, WITH OR WITHOUT THE RADIO-KNIFE

Mortality: 12 per cent
Recurrences: 15 per cent
Apparently well: 17 cases, or 60 per cent of operative survivors:

Year	−1	1	2	3	4	5	6	7	8	9	10
No. of cases	3	1	6	..	1	2	1	..	3	..	..

Apparently well, controlled by cystoscopy, 11 cases.

operated causes is somewhat better than in the cystoscopic series, 15 per cent recurrences in those controlled; but there is a primary mortality of 12 per cent plus attached to this procedure, which is surely higher than in the cystoscopic treatment.*

* Our records show 1 fatality in the cystoscopic method caused by a bacteremia following cystoscopy.

Of 29 cases surviving operation, 20 were followed and 17 were apparently cured, or 60 per cent.* It is difficult to see why these cases should not suffer from new benign or malignant tumors just as often as the first series. More extensive experience will probably clear up this point, as more cases submit to regular cystoscopic control.

As I consider all steps in this operative procedure of fundamental importance, aimed as they are against implanting tumor cells in the bladder or in the parietal wound, the following description and illustrations are presented.

removed all the cancerous depots in the bladder wall or not, while in papillary tumors such difficulties are much less frequent, for the obvious reason that one can see the growth in its entirety. The cure of cases of papillomatosis speaks well for a surgical procedure and is an excellent test of such a procedure, while frequent recurrences speak against such a procedure. Even under older methods, when less

FIG. 13.

TECHNIQUE

The more carefully one studies the results of surgery of bladder neoplasms, the more evident it becomes that successful treatment depends upon the avoidance of tumor cell implants; for recurrences, except in the infiltrating malignancies, where they may be due to incomplete operations, are usually due to such implants. The successful treatment of papillary tumors, benign or malignant, is, strange to say, a better test of treatment than that of infiltrating carcinomata, as in the latter it is always difficult to determine whether one has

* Eighty-five per cent of followed cases.

attention was given to the implant aspect of the problem, occasional operative cures were scored. Under the present technique, results are ever so much better..

I have favored the extraperitoneal approach[4] since 1912, and Squier, Voelker, Latzko, as well as others, use the same approach in cases demanding bladder wall excision. Briefly, the technique follows:

1. The bladder is gently irrigated and then emptied so that when it is opened the wound is not flooded with fluid containing tumor cells.

2. The patient is placed in a moderate Trendelenburg position and a wide vertical suprapubic incision is made.

3. As the bladder is exposed extraperitoneally, it is freed from its bed of fat and peritoneum by blunt dissection to either side of the urachus, which is double

clamped and cut between. The clamp on the bladder end of the urachus is used to draw the bladder forward and towards the symphysis as the peritoneum is sponged off its posterior surface. This may be opened accidentally and will allow palpation of the extent of infiltration, etc., of the walls of the bladder.

4. After the bladder has been well freed down to or beyond the trigone in this manner, the perivesical space is carefully packed off with several layers of gauze abdominal pads, which protect the perivesical space and the incision in the parietes.

5. Then, depending upon the position of the growth or growths, the bladder is incised either through its anterior, its posterior or its lateral walls. The incision should be gradually enlarged so that wipes or suction can sponge up the little fluid that may be in the viscus. Sponging within the bladder should be reduced to a minimum. As the incision is enlarged the papillary growth will become evident, and it is immediately cauterized in situ with the bipolar current, as previously described or with the electric cautery (hook) or with the Paquelin (hooked point). In cases of multiple growths each growth is separately burnt, and every suspicious spot is treated

similarly. A too-extensive cauterization is preferable to one too-superficial.

6. Having a rather deep cavity to expose, it is wise to use retractors of different sizes and lengths, rather than automatic retractors,* so that all surfaces of the organ can be gone over readily, and none are covered except momentarily by the blades of the retractors. Again, to hold the organ well out of the body, clamps without teeth are applied to the bladder incision as it is being made. The use of clamps with teeth such as the Kocher, which produce minute perforations in the bladder wall, thus possibly producing implants, should be avoided.

7. Being satisfied that all the visible tumor or tumors have been destroyed, our next efforts are directed against possible cell implants. These may be in the bladder incision, loose in the bladder or on the gauze protective packings about the organ. The incision which opened the bladder may be lightly seared with the electrode, proceeding from clamp to clamp in orderly fashion, each clamp being removed in turn as the cauterization proceeds. Then the table is lowered, and the whole wound is filled for about five minutes with alcohol,

Fig. 14.

* An automatic retractor in the parietal wound is essential and helpful.

the bladder being allowed to slip back into its bed so that its cavity as well as the protective gauze is exposed to the effects of the alcohol which it is hoped will coagulate any potential cell implants that have broken away during the various manipulations.

8. After this thorough bath in alcohol, the gauze protective packings are removed and fresh gauze is substituted. The bladder is sponged dry and its incision closed, after

be difficult to decide whether there is an infiltrated base. If there is doubt, it is well to place some radium seeds in the suspicious area, running them obliquely to the lumen of the bladder lest one produce an extravesical infection by introducing the seed too deeply into the mobilized bladder wall.

In malignant tumors of the bladder, papillary carcinomata and solid infiltrating

Fig 15

making provision for suprapubic tube drainage. In closing the bladder, a layer of plain) catgut sutures is used to infold the charred edges of the incision, and over this a layer of chromic gut is applied to support the first layer.

9. The incision in the parietes is closed in layers, and drainage with rubber dam or gauze to the bladder, both above and below the tube which enters that organ, completes the procedure.

From a consideration of the above points, I believe it will be agreed that everything that can be done to minimize the danger of implants has been utilized and it must be evident that such a thorough technique could only be carried out through an extraperitoneal approach.

After the pedicle of these apparently benign tumors has been coagulated, it may

carcinomata, wherever possible we resect after mobilizing the bladder; in the former, usually a less wide resection is required than in the latter; in some cases part of the bladder wall is destroyed and radium seeds placed in the base. In tumors of the posterior wall which are liable to extend to the serosa, it is advisable to enter the peritoneal cavity before opening the bladder: then as the bladder is mobilized, the involved serosa can be left attached to the growth and the opening in the peritoneal cavity can be closed prior to incising the bladder wall. Here again we coagulate with diathermy the whole surface of the growth with one pole in the bladder, and with the radio-knife we make a rapid resection. If a ureter is involved it is reimplanted, after the flooding with alcohol, by the simplest technique drawn into and attached to the

inside of the bladder without any tension and also fastened to the outer wall of the bladder with a couple of chromic gut sutures. By using the radiotherm and diathermy in this way, we often do an extensive resection without tying a single blood vessel. If a vessel must be clamped, its lumen is readily closed by touching the diathermy current electrode to artery forceps. This coagulates the tissue at the bite

case, cystoscopic controls were negative, the last being four years after the operation.

Since 1912 there have been 28 cases of papillary carcinoma, in 15 of which part of the wall, though not the whole thickness, was resected and cauterized, with actual cautery originally and later diathermy, and in 13 cases the whole thickness of the bladder wall was resected. In 3 cases radium seeds were introduced into the coagulated
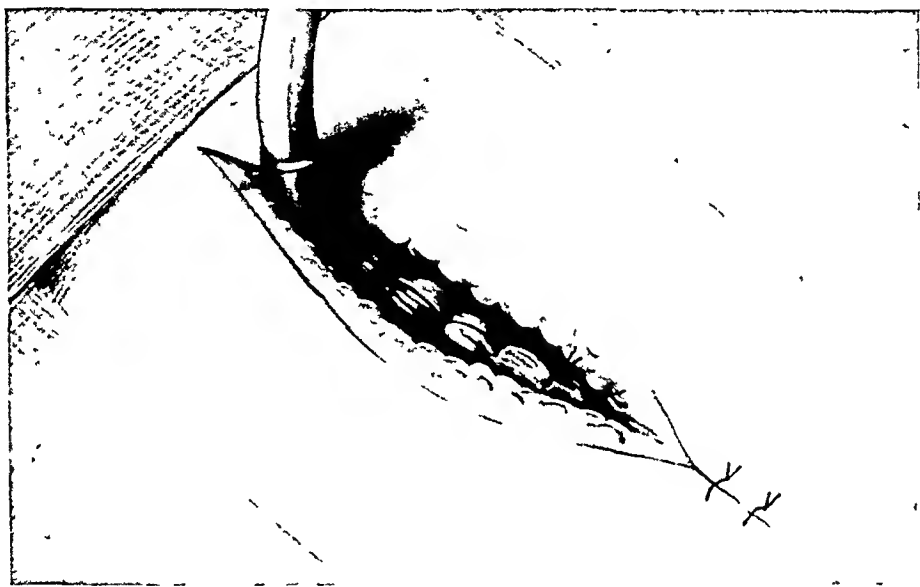
FIG. 16.

and the forceps may be removed without any bleeding.

Unfortunately, a great many cases present themselves so far gone in their malady that this more or less ideal resection cannot be done. If one takes only the simpler cases, the operative mortality will be correspondingly low, but if a good result has been obtained after a most extensive resection, one is liable to feel encouraged to attempt a repetition, or even attempt more hopeless cases. This frame of mind is quite natural in developing a field in which the therapy has not been stabilized. Previous to 1912, I find records of 5 cases of infiltrating carcinomata done transperitoneally, of whom 2 died in the hospital, 2 developed local recurrences, and 1 was cured, but died of apoplexy six and a half years after the operation. In this

base. The mortality in this series was 14 per cent. Of those that survived, 15 are alive and apparently well, or 60 per cent of the 24 who survived operation. Four could not be traced; 6 had recurrences (25 per cent), and of these, 1 was re-operated and is well one and one-half years after second operation.

TABLE III

SUMMARY OF 28 CASES OF PAPILLARY CARCINOMA AS TREATED BY OPEN OPERATION

Operative mortality: 14 per cent
Recurrences: 25 per cent
Apparently well: 15 cases, or 60 per cent of those surviving operation, as controlled by cystoscopy:

Year.......	—1	1	2	3	4	5	6	7	8	9	10
No. of cases	2	2	2	3	1	2	1	1	..	1	..

From this small series one cannot decide whether the whole thickness of the bladder

wall should be removed. Some of the oldest cases had only a partial removal of the bladder wall. All in all, there is no striking difference between the end-results that can be attributed to the amount of bladder wall removed, which is probably due to the fact that there was no extensive infiltration at the pedicle. From the few cases in which radium was used, no deductions can be made, though 1 case has gone three years since the operation.

The mortality in the 18 cases with ureter transplantation (2 simple ligations) was the same as when the ureter was not involved. Of this group, 1 patient was alive and well almost ten years, 1 six years, 1 five years, 1 three years, 1 a year and a half. The five- and three-year well cases were controlled by cystoscopy. The end-results to date would be, 5 patients well out of 14, or 35 per cent, which is better by a little than the whole group of reseted infiltrating solid
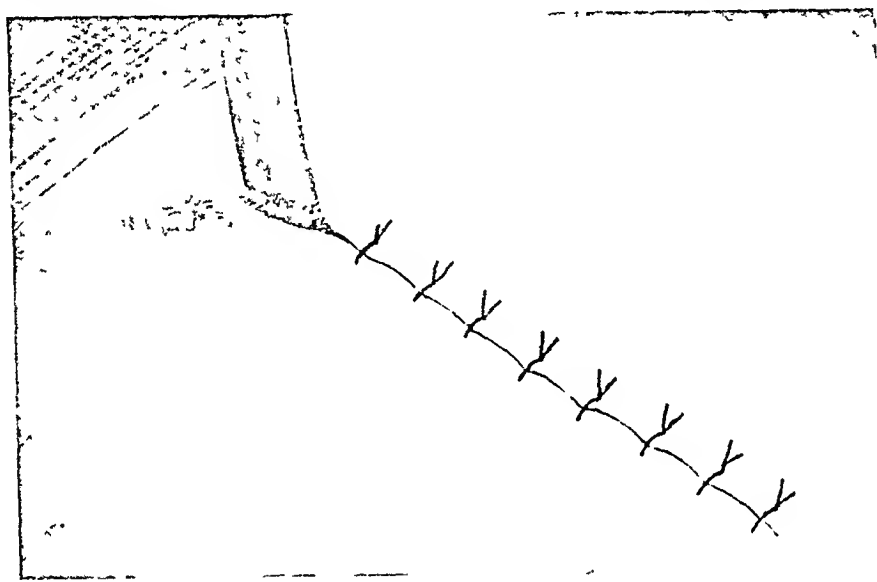
Fig. 17.

The most difficult cases to treat are the definitely infiltrating carcinomata, of which we resected 37 cases, with re-implantation of the ureter in 17 cases. Eight cases died in the hospital (21 per cent); 16 cases are fairly definitely known to have developed recurrences; and 13 cases are alive, 6 of them controlled by cystoscopy and with no recurrence.

carcinomata. This may be due to the fact that the excision, naturally, was more extensive.

It is of interest to note that in this group 4 cases had preoperative deep roentgen ray about three weeks prior to operation, with the object, usually, of shutting off the vascular and perhaps the lymphatic channels, to avoid dissemination by the operative trauma as well as to devitalize the carcinoma cells (though histological studies did not confirm this). The fibrous tissue about the bladder, resulting usually from such roentgen-ray exposure, renders the operation of extraperitonealization more difficult, but in view of the fact that all 4 cases failed to develop recurrence, this should receive further consideration and study.

In this group as well as in the preceding

TABLE IV

TABLE OF 37 CASES OF INFILTRATING CARCINOMA TREATED BY RESECTION WITH OR WITHOUT URETER TRANSPLANTATION

Operative mortality 21 per cent
Recurrences 43 per cent
Apparently well 13 cases, or 35 per cent of those surviving the operation

Year.	−1	1	2	3	4	5	6	7	8	9	10
No. of cases	2	2	1	2	1	2	1	1	.		1

Apparently well, controlled by cystoscopy, 6 cases.

group, the physical agents, the high frequency current in the form of electro-coagulation, or diathermy with the radio-knife, has surely introduced a change for the better, even though we are not justified in considering the above 28 cases as definitely cured. In these cases the biological variations of the tumors are such that even after five years following a total cystectomy, I have found at autopsy carcinoma tissue in the iliac glands and along one ureter. These patients also object to re-cystoscopy which, moreover, in a deformed resected bladder may be inconclusive. The best we can do is to determine whether they are alive and apparently well, realizing that there is always a danger of recurrence which will bring our statistics of satisfactory end-results to lower figures.

3. THE USE OF RADIUM THROUGH THE CYSTO-SCOPE AND THROUGH A SUPRAPUBIC CYSTOSTOMY

One of the most recent physical agents to be used effectively in bladder neoplasia is radium. In 1911, with an inadequate supply, I tried this without success and shortly thereafter, reading Paschkis' unfavorable report, I abandoned my efforts for years, though originally I felt that it might prove as useful as the high frequency currents used through the cystoscope, if not more useful.

Under the great stimulus of B. Barringer, this field was again explored, and we treated 16 cases with radium emanations introduced through the cystoscope. There were two types of cases in which it was employed: first, in patients with multiple tumors which varied in their appearance from soft typical benign to almost solid growths. In these, specimens from the former tumors were microscopically benign, and from the latter carcinoma was reported. Into these solid growths 1 to 4 seeds of 2½ mc.* were introduced, and then at the next sitting the necrotic growths were further annihilated with the high frequency

currents. In these cases we had excellent results. In the second group, we imbedded seeds because, owing either to the position of the growth near the sphincter or to the general condition of the patient which made operation seem inadvisable, our results have been most unsatisfactory. This is probably due to the fact that it is impossible to place the radium regularly where it will destroy the whole tumor, the procedure even in the open bladder being somewhat of a "hit-or-miss" affair. In all we have used radium through the cystoscope in 16 cases. In 8 cases we have had excellent results and the tumors have been destroyed; these belong in the first group. In the second type, I cannot find a single cure or disappearance of the growths.

Radium seeds (rarely surface applications as well) were used through the open bladder in definitely infiltrating carcinomata, where the growth could be definitely felt with one finger outside and the other within the viscus and the infiltration established, in 31 cases. It has been claimed by some that the mortality in this procedure is so low that it should be the routine method of attack in all malignant growths. In our experience, the highest mortality was seen; 11 cases died, or 33 per cent. It must be admitted that most of the cases were very extensive, often involving the sphincter area, and anything short of a total cystectomy with prostatectomy would have been quite impossible to effect a radical excision. Wherever we could resect, we did so. If we had permission for total cystectomy (5 cases), we did this operation. In the absence of these two conditions, we have always had radium present in the operating-room so that we would not be compelled to do a simple drainage operation or a more or less superficial electrocoagulation. Of these 31 cases, 1 treated with B. Barringer was cured of a solid growth close to the sphincter as controlled by 10 cystoscopies over five years. At the eleventh cystoscopy, a benign papilloma was detected in a new site on the posterior

* Originally glass seeds of ⅛ to ½ mc. were used, but of late, platinum seeds of 2½ mc.

wall and destroyed with the high frequency current. One is alive after three and three-quarter years and developed a papillary carcinoma in the posterior urethra. One was well and lived three and a quarter years; one two and a third years; and 2 others lived two years also without recurrence. In at least 2 cases we saw no result. Three cases were not controlled, and 7 died or are suffering from their disease; 2 cases are too recent to be of any value.

From these figures it is seen that of the 20 cases that survived the operative procedure, 6 were cured of their original neoplasms, or 30 per cent. When we consider the type of case included in this group, it is evident that radium emanations used as seeds have surely improved the outlook for these otherwise hopeless cases. Before radium was available we all saw countless cases in whom we never got further than a simple cystostomy, if they consented to that much. In my personal records I have 52 such cases prior to the radium era. In addition to these, numerous cases of recurrences following operation elsewhere, or absolutely hopeless and untreatable cases are found in our records. This tragic picture we expected to see changed with the introduction of the roentgen-ray therapy.

4. THE USE OF DEEP ROENTGEN RAY

When the deep roentgen-ray was heralded, we all turned to it with expectancy, hoping it would be an aid in this field. We used it in the primary inoperable carcinomata and the recurrent inoperable

TABLE V

SUMMARY OF RADIUM CASES TREATED CYSTOSCOPICALLY AND THROUGH SUPRAPUBIC INCISION. RADIUM SEEDS USED IN 47 CASES

GROUP A: 16 cases. Radium seeds introduced through cystoscope:
   No mortality
   8 apparently cured
   8 recurrence or no effect
GROUP B: 31 cases. Radium seeds introduced through suprapubic cystostomy:
   Mortality: 33 per cent
   6 cases controlled and apparently well out of the 20 that survived operation, or 30 per cent

carcinomata with an almost uniform negative result. L. T. Mann has recently reviewed 17 cases of papillary carcinomata and infiltrating carcinomata of the bladder, and in only 3 cases had there been any relief of dysuria and hematuria. There were no cures and life apparently was not prolonged. As these cases were treated by various experts, the uniformity of the bad results is all the more striking. It is difficult in view of our experiences to give much credence to some of the recent reports on the efficiency of the deep roentgen-ray treatment in these conditions. Whether deep roentgen-ray treatment prior to cystoscopic high frequency treatment will prove of any value, in the sense that some claim, of an adjuvant action between radium and the high frequency current, I do not know, but some observations have suggested that this relation may exist.

In this brief report, I have attempted to survey our experience with the various physical agents used with and without cutting operations. I regret that I cannot give a better picture of the situation and a more glowing series of end results. I have purposely condensed the material as much as possible.

SUMMARY

During recent years there has been a great change in the outlook of patients suffering from bladder neoplasm, owing to the introduction of physical agents. Though much has been accomplished, especially in benign growths there is still considerable work to be done in the malignant growths, especially in the infiltrating non-resectable carcinomata. Our experiences in over 400 cases are detailed in the printed report, and here I shall attempt to give a brief résumé.

Amongst the physical agents employed are:

1. Various modalities of the high frequency currents through the cystoscope.

2. The use of these currents through the opened bladder combined with alcohol to prevent implantations.

3. Resections of the bladder with the radio-knife actuated by a very rapidly oscillating (1,200,000) high frequency current.

4. The use of radium seeds (emanations)
   (a) through the cystoscope
   (b) through the open bladder

5. The use of deep roentgen ray

1. The trans-cystoscopic use of the high frequency currents has given excellent results. Both the original growths and any possible recurrence are readily destroyed. There are well-recognized differences in the effect of both the so-called monopolar and bipolar currents, the former being more explosive and of higher tension, while the latter is of higher amperage. The distant action of the bipolar is of great use in producing a massive coagulation in the pedicle, as can be demonstrated on a piece of raw beef properly shaped so as to simulate a pedunculated growth, or when the bladder is open and the papilloma is seized and raised with a blunt forceps and the bipolar current is allowed to run down this forceps into the growth. It produces an extensive coagulation at the pedicle and adjacent bladder wall. The monopolar current has a similar distant effect but much less marked. The ideal treatment through the cystoscope would be by means of a forceps electrode, which could be as readily applied as the above forceps through the open bladder.

Only benign growths should be treated with these currents, and if in doubt as to the cystoscopic accuracy of diagnosis, a biopsy, occasionally a cystogram, will aid in establishing the nature of the growth. Lack of adequate response to the current speaks against its benign nature. There are benign cases which do not lend themselves to cystoscopic treatment, e.g., extensive papillomatoses, tumors at the neck, or in inaccessible situations, tumors that bleed profusely at every examination, etc., and these are treated better by open operation.

The trans-cystoscopic treatment has given us in over 158 cases excellent results.

In about 20 per cent we see recurrences in a new situs or in loco, the latter due to incomplete destruction and the former to possibly overlooked growths or to new growths resulting from the original causative agent.

2. In the operative treatment everything must be done to avoid implants. Good exposure by extraperitonealizing the bladder in the Trendelenberg position, careful packing-off of the wound, and operating on the empty bladder assist us in reaching our goal. The bladder is opened with the radio-knife and as the growths present, they are coagulated with the current and removed with the cutting needle (curved). We used to use the Paquelin, later the electrocautery, but for two years we have been using the radio-knife. We have had 33 cases in which this procedure was necessary, and our apparent end-results with this technique are excellent though there is a primary and considerable mortality. Eighty-five per cent of the survivors are apparently cured. We say apparently, for it is difficult to tell when a case is to be classed as cured, having seen, five years after a total cystectomy and apparent health, carcinoma in the iliac glands. Cystoscopic control is essential and it is notorious how difficult it is to persuade patients to submit to regular reexaminations. We are convinced that flooding the wound with strong alcohol, which coagulates potential implants (free tumor cells), has been of greatest value.

3. In carcinoma cases, the papillary and the infiltrating, we use practically the same technique as under (2) coagulating the growth and then resecting. We always have radium present so that in case the growth cannot be resected, we can try to destroy it with this physical agent. Of this group we have had 65 cases (28 plus 37) with apparent good results in 60 per cent of the papillary carcinomata and 35 per cent of the infiltrating carcinomata.

4. Radium emanations we have employed in 16 cases trans-cystoscopically,

with apparent successes in 50 per cent; whereas radium applied through the open bladder in non-resectable growths, usually at or near the sphincter, has given us our highest mortality (33 per cent), and only 6 cases (30 per cent) of the total of 31 cases seemed to be cured.

5. In 17 cases of carcinoma, we tried the deep roentgen ray without any curative effect, though occasionally there was some amelioration of the symptoms.

From this summary, it is evident that the picture has changed materially, and instead of advising "Hands off!" in these growths, we are now getting results that we can be proud of, even though we are far from the goal at which we are aiming.

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THE TREATMENT OF
GENITAL TUBERCULOSIS*

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NEW YORK

AT the Congress in Brussels there was a discussion on genital tuberculosis, and some items brought out were not uninteresting.

The first paper was by Dr. J. Dellinger Barney, of Boston; the second by Drs. Carlo Gamberini and Pietro Marogna, of Italy; and the third by Dr. Kenneth M. Walker, a British surgeon. Neither Dr. Barney nor Dr. Walker ventured into any very extraordinary researches, but put forth sound doctrine, Dr. Barney repeating the general impression that tuberculosis begins in the epididymis, rather than in the prostate or in the genitals, and Dr. Walker not even committing himself on that point. They advised epididymectomy, etc.

Drs. Gamberini and Marogna were more interesting, because they favored a type of treatment which we are not familiar with here. The treatment goes by the name of "Durante." The method is the multiple injection into the tuberculous nodule of small amounts of an iodide solution, if the nodule has not yet broken down. If the nodule is cheesy, it is incised and curetted, and 10 per cent iodoform and glycerin injected. As healing progresses, the injection is repeated on the third to the seventh days. Thus resorting to epididymectomy is avoided. They spoke as if the prevailing custom in Italy were this injection system.

This was extremely interesting to me, because I have been faced a good many times, as anybody who does consultation work is, with the problem of a patient who has had one testicle removed with a guarantee that this would cure his genital tuberculosis. Even if a cure does result on this side, he often develops a tuberculosis of the opposite side. And when tuberculosis appears on the second side, he is so frightened he does not come to a physician until the disease has become very extensive. Then he comes, full of anxiety lest he lose the second testicle. We hesitate to attempt epididymectomy, because the whole mass is so indurated that it seems impossible to enucleate without interfering with the blood supply of the testicle.

In the last few years it has been my practice in such cases simply to curette out the foci, incising the tunica vaginalis, delivering the testicle in the usual way and splitting the epididymis end-to-end, curetting out all the tuberculous foci and suturing the skin with catgut to the edges of the gutter. The result is a very slow healing. The focus remains open. At the end of the eighth or ninth month it is fairly well healed, the induration has contracted upon itself, and there remains at the upper or lower end of the epididymis a small tuberculous nodule with a fistula leading to the skin. When the rest of the healing is complete, and the testicle seemingly normal in shape and size, it is simple to excise the nodule and do a real cleaning up of the scrotal tuberculosis, leaving the patient what looks like a beautiful testicle.

This is really doing the same thing as the Italians do in a more complicated way by iodine injections—a cleaning up of the focus without actually attempting to excise it. I do not see the virtue of the iodine treatment when epididymectomy can be done. In all advanced conditions I would advise this operation, which gives satisfactory results.

Dr. Marion spoke in the discussion at the Conference and excepting one other, who spoke on differential diagnosis and

insisted upon the difficulty of distinguishing tuberculous from non-tuberculous cases where there had been a gonorrheal epididymitis, Dr. Marion's remarks were the most interesting. He stated that many years ago he had begun doing an epididymectomy on the normal testicle as a matter of routine at the time he excised the diseased epididymis, in order to prevent recurrence of the good side. I have had a good deal of interest in that for a number of years, because many of these patients are sterile at the time they first come to the doctor for a tuberculous epididymitis. Specimens of the semen have showed sterility, in which case vasotomy was done on the opposite side. On such patients I have not happened to see a tuberculous epididymis of the second testicle. Yet I have had this curious experience: In 3 cases which came for epididymectomy there were spermatozoa in the semen, and I therefore did not do a vasotomy on the opposite side; and within eighteen months two had tuberculosis of the opposite epididymis.

Therefore I wonder if Dr. Marion is not quite right in saying it is wise to remove the second epididymis at the time the first is found tuberculous. My discouraging experience seems to point to taking radical steps and removing the second epididymis, which will surely protect the second testicle.

DISCUSSION

Dr. J. Sturdivant Read. I was struck with Dr. Keyes' contribution about curetting tuberculous abscesses in the epididymis. We have all seen cases where these abscesses have broken spontaneously, and the cases were really cured for a long time. I found the gist of the treatment he suggested very useful.

Dr. Paul Aschner. I tried resection once, and gave it up. In this instance I did an epididymectomy on the diseased side and ligated on the other side, and two weeks later the patient had a tuberculosis of the other epididymis. Infections travel through the blood stream, and not by way of the vas deferens.

Dr. Edwin Beer. In the course of Dr. Marion's presentation, he called attention to the fact that he used to tie off and cut off a piece of the vas, and was surprised to find a tuberculosis developing at the stump, and he had therefore resorted to the policy Dr. Keyes has referred to.

At the last meeting, Leguen presented studies of pyeloscopy and ureteroscopy. By pyeloscopy and ureteroscopy he means direct fluoroscopic inspection of the pelvis and ureters as they are filled and as they empty. He gave a very dramatic presentation of his observations, calling attention to the peristalsis in the pelvis and its resemblance to the duodenal bulb, and also emphasizing the striking pictures produced by the peristaltic waves in the ureter. He referred to one of our colleagues who had spoken to him concerning 300 cases of ureteral stricture observed during the last two months in his practice. Professor Leguen stated that he had seen such pictures which might be interpreted incorrectly, and that peristaltic waves often simulated strictures. In his experience in these studies, stricture of the ureter "N' existe pas."

Dr. Edward Keyes. Replying to Dr. Aschner: I have curetted 5 cases, and so far have had no complications. I agree, however, with the contention of the possibilities of complications; but so far I have not seen any.

COMPARATIVE VALUE OF VARIOUS
BLOOD AND URINE EXAMINATIONS
IN URINARY SURGERY*

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THE International Urological Society, an association of long standing, reorganized in 1919, is composed of members from the various countries throughout the world, such members being subjects of a state received in the League of Nations in 1919. The object of the Society is the study of all questions relating to urology, including anatomy, physiology, chemistry and medical and surgical pathology; a Congress is held every three years.

Up to the present time all of the meetings have been held abroad. The next Congress will be held in Madrid in 1930, and three years later it is hoped that the Congress will be held in New York City.

There is no limit to the number of guests that may attend the sessions, and although they do not take part in the scientific discussions, they are welcome to the meetings and all social functions incidental to them.

These meetings are unique both because of their international character, the high standard of the scientific papers and clinical work presented, and also because of the unusual settings and social features.

The meeting held this summer in Brussels was no exception, for the city, abounding in historic and artistic treasures, was thrown open to us and we were privileged to view many priceless collections, interesting buildings and homes not seen by the regular visitor to the city.

The hospitality of our hosts was unbounded and genuine, their entertainments interesting and dignified, and their scientific work serious and well executed, so that we came away feeling enlightened, broadened in our viewpoint, pleased with new acquaintances and the opportunity that we had had of discussing our problems with them, and looking forward to the next meeting, three years hence.

As Americans we were justly proud of our representatives—Dr. Keyes, never at a loss to do the right thing at the right time, upheld the standard and dignity of American urology by his address at the opening of the Congress, his scientific discussions, his familiarity with continental customs, fluency in French and ever-present humor; and we are all proud of his election as the permanent President of the Society.

Dr. Beer was awarded the gold medal of the Society in recognition of his splendid work on the treatment of bladder tumors, which was characterized as "the best piece of work in recent years in the advancement of urology."

These honors were well deserved and characterize American urology, placing it second to none. Both in their papers and in their clinical work it seems to me that the men in this country approach urological problems with a much more clear-cut, definite, unprejudiced mind, get down to facts sooner and apply their knowledge to better advantage, yet never losing sight of the welfare of the patient, their first consideration. This was apparent in the first group of papers on the subject of "The Comparative Value of the Various Examinations of the Blood and Urine in Urinary Surgery." H. Chabanier of Paris read the first paper on this subject: "The Comparative Value of Different

Methods of Examination of the Blood and Urine in Urinary Tract Surgery."*

SUMMARY OF H. CHABANIER'S PAPER

The author first considered various methods for determining the total renal function:

1. Urine analysis.
2. Determining the excretion of certain substances introduced into the organism: the phenolsulphonephthalein test.
3. Determination of certain chemical substances in the blood, especially the blood urea.
4. Special tests based on Ambard's method.

The determination of the amount of various substances, especially urea, excreted in the urine is not sufficient to determine renal function. Extrarenal metabolic factors affect the elimination of different substances. With urea and other nitrogen products, the organism tends to maintain nitrogen balance; when the kidneys are diseased, the balance is attained more slowly.

The excretion of certain substances such as phenolsulphonephthalein, is also influenced by extrarenal factors. The excretion of phenolsulphonephthalein depends not only on renal function, but also on the condition of the circulation and the liver function, as recent investigations have shown.

The value of the determination of blood urea as a measure of renal function was first demonstrated by Widal in 1904. This was the basis for the subsequent work of Ambard, who determined the formula for the "ureo-secretory constant," a urea index as an index of kidney function. Ambard found that, other things being equal in regard to renal function, the blood urea values vary directly with the excretion of urea in the urine; also that, other things being equal in regard to urea excretion, the blood urea values vary directly with the degree of alteration in the kidneys.

* International Society of Urology, Third Congress, August, 1927. Vol. 1, pp. 89–179.

In comparing the blood urea values and the Ambard urea index in a large series of patients, Chabanier found that with blood urea values below 1 gm. per 1000 c.c., the variations in blood urea do not indicate the true renal function as shown by the urea index. Blood urea values constantly above 1 gm. were a practically certain indication that the renal function was about 10 per cent of normal.

Chabanier then discussed the work of Ambard and the laws on which the determination of his formula was based. He stated that Ambard has shown that the constant determined by his formula is independent of the intensity of nitrogen metabolism, whether much or little urea is elaborated by the organism. It depends both on the quality and quantity of the functioning renal parenchyma.

Ambard and Papin have also pointed out the importance of the maximum concentration of urea; if the volume of urine diminishes, while the quantity of urea produced by the organism increases, the concentration of urea in the urine will increase, but not above a certain value, one which is called the maximum concentration. This maximum concentration of urea may be determined by giving 5 to 6 gm. of urea every half hour and determining the concentration of urea in the urine at the same interval, until this concentration remains at practically the same level. This procedure, however, sometimes causes nausea, and sometimes produces a diuresis which makes it impossible to determine the limit of concentration.

Another procedure proposed by Legueu, Ambard and Chabanier gives better results. This is to give the patient the curd of 3 liters of milk each day without other food and with a limited amount of fluid. The concentration of urea in the urine is determined daily until a fairly constant level is reached. The test may be carried out for four or five days, but in nephritic patients two to four days is usually sufficient to establish the maximum concentration. In normal persons the maximum

concentration of urea in the urine is approximately 50 gm. per 1000 c.c.; with nephritic patients it is less. The maximum concentration of urea in the urine does not depend on the amount of functioning renal parenchyma, as has been shown in animal experiments and in man after nephrectomy. It depends on the quality of the functioning renal parenchyma.

In cases in which the urea concentration in the urine reaches its maximum spontaneously, i.e., under the patient's ordinary conditions of life, this concentration cannot increase even under such special circumstances as produce a change in the volume of urine. Any decrease in volume results in a diminution in the amount of urea excreted and in urea retention in the blood. When such a maximum concentraction of urea in the urine is reached and maintained, the excretion of urea ceases to depend on the amount of blood urea and becomes solely the function of the urinary volume, and Ambard's ureo-secretory constant is no longer applicable.

From these considerations, the author concludes that it is not possible to determine renal function solely by urine analysis. Tests of the elimination of certain substances introduced into the organism, such as dyes, depend on too many extrarenal conditions, not yet fully understood, to serve as accurate tests of renal function. The determination of blood urea alone without control of all factors of nitrogen metabolism does not indicate the renal function exactly, unless the blood urea value is constantly above 1 gm., in which case the renal function is less than 10 per cent of the normal. The determination of Ambard's ureo-secretory constant indicates the actual function of the kidneys, except in cases where the maximum concentration of urea in the urine is attained. In such a case this maximum concentration must be determined. The latter condition should be suspected in cases with a diminished volume of urine, a low value for urea excretion, and a rapidly increasing

blood urea. In other cases with blood urea below 1 gm. the Ambard ureo-secretory constant should be determined.

In determining the function of each kidney separately by ureteral catheterization, Chabanier has found that the determination of the volume of urine obtained from each kidney is not a true indication of the function. The comparison of chloride excretion also is not of value, as the question of renal threshold for chloride complicates this determination. The best method for determining the function of the kidneys separately is a study of the urea excretion by each kidney. Both the total urea excretion and the urea concentration in the urine from each kidney are determined, a method of catheterization being used which permits collection of the urine filtering out along the ureteral catheter from each kidney.

The kidney which shows the higher concentration of urea and also excretes the larger volume of urine has the better function; but if the kidney with the higher concentration of urea excretes the less urine, this determination is not of value, as the difference in concentration may be due only to the difference in volume.

If the kidney that excretes the greater amount of urea also excretes the smaller volume of urine, it has the better function. If neither of the two conditions of higher concentration of urea and greater volume of urine, or of greater amount of urea and lower volume of urine be found for either kidney, the urea excretion for each kidney must be calculated for a standard concentration, 25 gm. per 1000 c.c. The urea excretion of each kidney calculated at 25 gm. per 1000 c.c. indicates the function of each kidney.

The determination of the excretion of various substances, not normal constituents of the urine, after the ingestion or injection of these substances, such as phenolsulphonephthalein, is not so good an indication of the relative function of the two kidneys, either from a theoretical or a practical viewpoint.

The absolute function of each kidney can be determined in the same way as the total renal function, i.e., either by determining the Ambard ureo-secretory constant or by determining the maximum urea concentration for each kidney. The determination of the Ambard constant for each kidney involves a difficult technique and is not to be recommended for practical clinical purposes. The determination of the maximum urea concentration of each kidney is not open to this objection.

A surgical operation may result in urea retention of varying severity, sometimes so severe as to cause death. Neither the probability of such a crisis of nitrogen retention nor its severity can be predicted by any of the tests of renal function based on the various methods of blood and urine analysis now used in urology. It has been found that a severe crisis of nitrogen retention may follow operation on a patient who before operation had a normal Ambard constant, while a patient who showed a low constant may develop no such crisis after an equally severe operation. The author notes that a crisis of nitrogen retention is less likely to develop after nephrectomy than after certain other genitourinary operations, especially prostatectomy. This is due to the fact that in most cases of nephrectomy the maximum urea concentration in the urine of the remaining kidney is usually normal, indicating a qualitatively normal function. But, as a rule, in spite of the fact that the methods of determining renal function are scientific and precise, there is not such a precise method for estimating the prognosis as to the effect of operation on renal function.

SUMMARY OF DR. QUINBY'S PAPER

In contrast to this presentation of ninety printed pages, only a short summary of which I have given, was the paper of Quinby of Boston, which clearly and concisely gave an estimate of the value of tests of blood and urine in urological surgery as generally accepted in this country.

Quinby said that, in considering the function of the kidney from the clinical point of view, we are accustomed to view this organ in its purely excretory aspect, dealing with the transfer of a substance from the blood on the one side to the urine on the other. We know that, as one of the main parts of bodily metabolism, the kidney is engaged in a large measure in removing the end-products of the protein metabolism; the study of these nitrogenous end-products has made it certain that though the amount of urea, for instance, excreted by each healthy kidney is the same during any single time interval, in disease the amount excreted varies in almost direct proportion to the degree of injury in one or the other organ. The tests for renal function used in surgery are based on these facts: that a diseased kidney is incapable of excreting solids; and that the degree of impairment of this function is parallel in a general way to the degree of existent disease.

Tests of renal function should be simple for both surgeon and patient to perform, and should be accurate and delicate enough to demonstrate clearly the degree of damage to the kidney parenchyma.

After giving a brief history of the various tests of renal function, he cites extensive experimental work carried out in conjunction with Dr. Reginald Fitz, and concludes that we are today estimating the function of kidney by the phenolsulphonephthalein test, while for the estimation of the state of general protein metabolism we rely on the determination of the amount of urea in the blood. He states that two procedures brought out since this experimental work, namely the coefficient of urea excretion of Ambard and the urea concentration test of MacLean, have now little approbation in America, and as regards their accuracy and applicability, both are questioned when compared with the above.

Quinby described the technique of the phenolsulphonephthalein test for combined as well as separate kidney function, and

the curve of excretion as described by Shaw, with its interpretation. The estimation of blood urea serves in all cases as a means of comparison with the result of the phenosulphonephthalein elimination, and often when the urine cannot be accurately collected free from a mixture of blood, as just after prostatectomy, it gives information of much importance as regards the progress of the patient towards recovery.

These tests, being simple and relatively easy of performance, should be carried out at frequent intervals, he stated, for it is of much more value to know how much progress the patient is making and is capable of than to know what the kidneys are doing at any specific time.

In conclusion he expressed complete agreement with Young, that laboratory tests of renal function have given rise to endless discussion which is largely due to misunderstanding, the facts being that laboratory tests supplement but do not replace direct observation of the patient; that the additional information gained from laboratory tests is indispensable, and that no single test proves anything but is merely another element in the complete clinical picture we are trying to construct.

OTHER DISCUSSIONS

In discussing these papers fourteen members took part, each reading a summary of his views on the subject regardless of the formal papers presented, no reference being made to the arguments set forth by the writers of the papers previously delivered. There was very little brought out by the continental members that was clear cut. They seemed to depend more on Ambard's constant as a measure of kidney function and to be unfamiliar with the phenosulphonephthalein test, although some occasionally employed it. Thompson Walker depended entirely upon the comparison of the urea estimation of the blood and urine in his decision as to whether operation were justifiable and in estimating the prognosis in any given case.

Keyes summed up his views as follows: what the kidney has done is best determined by blood chemistry, what the kidney is doing by the phenosulphonephthalein test, and what the kidney will do by repetition of both and by concentration tests. In estimating the prognosis in urinary surgery no tests are of value, but it is best determined by the general condition of the patient. Brains alone will determine when or when not to operate.

Beer very clearly expressed his views regarding the value and necessity of the various tests of kidney function in urinary surgery, giving the particular virtues of blood chemistry, the indigocarmine test and phenosulphonephthalein estimations. He emphasized the sense of security given by such information.

In my discussion of the subject I cited clinical cases illustrating the inaccuracy of depending solely upon the estimation of blood urea as a test of kidney function, and also phenosulphonephthalein elimination alone, but the great value of the two when used together, and the necessity of repetition in eliminating technical errors and denoting progress, as well as in estimating progress. Other cases were mentioned emphasizing the value of the curve of phenosulphonephthalein elimination suggested by Shaw. The necessity of following the clinical signs and symptoms closely was emphasized and the rôle of functional tests assisting in diagnosis, especially in the absence of clinical manifestations and positive cystoscopic and urographic studies, was brought out; and I concluded with the statement that these tests of function should coincide with our clinical observations, cystoscopic and urographic studies giving us data which, with full knowledge of their limitations, complete the picture, and that they should be utilized at all times in diagnosing, outlining prognosis and in treating urological lesions.

TISSUE CULTURES

IN TWO CASES OF INTERSTITIAL CYSTITIS*

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I WISH to report the growth in pure culture of a streptococcus, from the tissue removed at operation in two cases of interstitial cystitis.

It has always been the consensus of opinion that interstitial cystitis is infectious in origin, probably secondary to some distant focus, and Hunner, Kretchmer and Keene have, in their clinical reports, taken great pains to trace, through exhaustive histories and careful physical examinations, evidence of a primary focus, with especial reference to the teeth and tonsils. These efforts have not been sufficiently successful to be conclusive.

Experimentally, very little has been done, with the exception of the work of Bumpus and Meisser, who report the production of lesions in the urinary tract, both in the bladder and kidney, following the intravenous injection into rabbits of a green producing streptococcus obtained from the teeth or tonsils of patients having interstitial cystitis. These experiments parallel very closely those of the same authors on pyelonephritis. In these cases a green producing streptococcus obtained from the teeth and tonsils of the patients was injected into rabbits, and produced lesions in the kidney and bladder. The organisms used in these two sets of experiments were so similar, as were the lesions produced in the animals that it would seem that more definite differentiation is necessary, in so far as the reproduction of interstitial cystitis is concerned. They did, however, demonstrate a diplococcus in the tissue removed from the patient's bladder, and Hinman, in his discussion of that paper, reported the culture of a streptococcus in one case, and proteus vulgarius and a colon bacillus in two others.

The two cases which I am reporting are of interest only because the same organisms were obtained from each. The first case is that of a woman forty-seven years old whose history was essentially negative for previous infectious diseases. Her bladder symptoms, consisting of frequency, urgency and pain, had been present for fifteen years. Her general physical examination was negative, except for several infected teeth. Urological examination revealed the urine to be clear, and free from infection. Cystoscopy showed the bladder capacity to be 250 c.c. On inspection the entire bladder mucosa was normal, with the exception of a spot on the anterior wall just behind the vesical orifice. At this point there was a well-defined submucous hemorrhagic area about 1 cm. in diameter, over which the mucous membrane was intact. It was well defined, and the mucous membrane surrounding it was normal. Both ureteral orifices were normal, and were seen secreting clear urine. They were readily catheterized, and urine sterile to culture was obtained. Functional tests and roentgen rays were normal. At a second cystoscopy the patient was anesthetized, and the bladder readily distended to 480 c.c. With this dilatation there were seen on the anterior wall of the bladder, in the region of the lesion described above, other lesions typical of interstitial cystitis. These were five in number, and all situated within 2 cm. of each other. They were fulgurated, but without relief to the patient, so resection was done.

At operation small pieces of the ulcerated areas were carefully placed in banana medium. On the third day a smear showed a pure culture of a streptococcus whose

characteristics I will outline after presenting the second case, since the organisms obtained in the two were culturally identical.

The second case is that of a woman forty-five years old who had been having frequency, urgency, and burning pain on voiding for several years. She had had a previous diagnosis of interstitial cystitis and a bladder resection elsewhere, with partial relief of symptoms. There was no history of previous infections.

At cystoscopy the bladder capacity was 180 c.c. The bladder urine was free from infection, as was that from both kidneys. On inspection the entire bladder mucosa was negative, except that on the right lateral wall about 3 cm. above the ureteral orifice there was seen a well-localized area of redness, over which the mucous membrane was intact, and surrounding which the mucous membrane was normal. The trigone also was normal. Under anesthesia the bladder was distended readily to 350 c.c., and in the region of the reddened area described above there was demonstrated a typical lesion of interstitial cystitis. This was resected, and the tissue removed dropped into banana medium.

In both of these cases at the end of three days there was obtained a pure culture of a very fine streptococcus. This was planted on blood agar and grew very slowly. The colonies at the end of forty-eight hours were barely visible, and at the end of three days appeared as very small, opalescent, almost dew-drop colonies. There was no hemolysis or green production.

The cultures were injected directly into the bladders of two dogs in each of the cases, and after two months the dogs were autopsied. No definite lesions were present at the site of the injections.

While it is reasonable to assume that the lesions in these two cases were caused by the organisms obtained, it is not to be inferred that this is the cause in all cases, unless the same bacteria can be obtained from a larger group of cases. The failure to reproduce the lesions experimentally may be due to several factors. The organism may not be virulent in dogs. Also, the lesion is one which develops very slowly, clinically, and it is common for patients to give a history of having had symptoms for many years, and so it may be that it is necessary to let the experimental animals go much longer before examining the bladders. Another consideration is that the production of the lesion may be dependent upon the constant supply of bacteria from a distant focus, which would not be obtained in a single injection.

These cases are of interest chiefly because the same organism was obtained from each.

DISCUSSION

DR. H. D. FURNISS: I wish Dr. Bidgood had gone further into some theory as to the possible origin of the streptococcus, and whether he found it in other portions of the body. I have had a number of these Hunner ulcers and have tried to eliminate infection in other portions of the body, by removal of tonsils, teeth, etc., with no effect on the ulcerations. In many cases one sees scars of an ulceration that has healed. Cases may be treated by fulguration or resection, and may or may not have a recurrence. Unless great care is taken in a resection of the bladder it is apt to be done insufficiently, and if, on the other hand, a sufficient amount is removed, it makes the operation formidable and leaves a very small bladder. Many men seem to doubt that there is such a thing as Hunner ulceration; it is my experience that unless you are very careful and have a brilliant light you are apt to overlook them. I have been impressed with the fact that the cases I have fulgurated in one hospital have done much better than those similarly treated in another hospital. The only variable factor that I know of in these cases is that in the one hospital the primary alternating current is taken directly from the street main and in the other it is taken from a direct current and transformed into an indirect current.

DR. N. P. RATHBUN: The paper illustrates one thing very forcibly, that is, the difficulty

of making streptococcus cultures. Often you can get a positive culture from the tissue itself. I have, however, in a few such cases by a very careful culture method forced the streptococcus to show, and in some of these cases I have found the same type of streptococcus in the teeth and tonsils—and the cases were cleared up by removing the foci. I have watched some of these cases over a period of years and have seen the ulcers heal in one place and reappear later in some other part of the bladder, with or without fulguration or other lines of con-

servative treatment. It would seem as if there must be some bacterial origin.

DR. C. Y. BIDGOOD: To answer Dr. Furniss's question regarding search for remote foci of infection, in the first case, several infected teeth were removed and cultures made, following Rosenow's technique. A mixed infection was demonstrated, with some streptococci among them; but they were not of the type obtained from the bladder lesion. The second case had had her tonsils removed previously, and no infected teeth were demonstrable.

A COLLECTIVE REVIEW OF STILL-BIRTHS IN THE LONG ISLAND COLLEGE HOSPITAL MATERNITY SERVICE IN THE YEAR OF 1926 WITH THE AUTOPSY FINDINGS, AND AN EXPLANATION OF FETAL MACERATION

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DURING the year 1926 there were 780 deliveries in the inpatient service at the Long Island College Hospital, with 39 stillbirths. These figures include nine premature macerated fetuses weighing less than 1200 gm., and three congenital anomalies. The following review is made of these still-births to ascertain the cause of death and to compare the findings with similar studies by various authors in America and Europe. The pathology of fetal death will also be discussed.

One must begin with definitions. A still-born infant, strictly speaking, is one born alive, as is evident from the beating heart, but not breathing and therefore lying still (Ballantyne[1]). An infant actually born dead is in strict parlance "dead-born." The distinction between stillborn and dead-born is not made in this study, but should be kept in mind. Death in the newborn is conveniently spoken of as of 3 forms: antenatal, intranatal, and neonatal, according as death occurred before the onset of labor, during labor, or within a short period after birth. An accurate analysis of the infant mortality of an obstetrical service requires a consideration of all these types of cases. This is obvious, since many neonatal deaths occurring in the first few days of life are due to conditions for which the obstetrician is responsible.

Unfortunately the present review does not include neonatal deaths, and its accuracy must suffer thereby. The infant death rate of 50 per 1000 calculated from the figures given in the first paragraph, gives too high an incidence of still-births if the prematures and congenital anomalies are included and too low an estimate of the mortality on the obstetrical service at this hospital, since neonatal deaths are not considered.

CAUSES OF FETAL DEATH

It is often very difficult to decide the primary cause of death in an individual case. This will become evident in the detailed discussion of the cases in this series. In a case of transverse presentation, for example, the child may die because of prolapse of the cord. Here transverse presentation is taken as the primary cause of death since the prolapse of the cord was favored by the abnormal presentation. Such arbitrary distinctions may leave room for disagreement, but the reason for the choice will be indicated in each case.

To facilitate later comparisons, it is best to adopt the etiological classification of dead-births and neonatal deaths given by Holland and Lane-Claypon[2] in their exhaustive treatise on the topic:

DEAD-BIRTHS AND NEONATAL DEATHS: ETIOLOGICAL CLASSIFICATION

1. Complications of Labor
    Contracted pelvis
    Transverse presentation
    Breech presentation
    Prolonged or difficult labor in:
        Face presentation
        Brow presentation
        Vertex Occipitoposterior presentation
        Vertex Occipitoanterior presentation
    Difficult forceps delivery
    Excessive size of fetus (including post-maturity)
    Premature rupture of membranes

Precipitate labor
Prolapse of cord
Coiling of cord round fetus
Dystocia of indefinite cause
Normal labor
  With excessive cranial stress
  With asphyxia
Others

II. Ante-Partum Hemorrhage
  Placenta Previa
  Accidental hemorrhage

III. Toxemia of Pregnancy
  Eclampsia
  Albuminuria of pregnancy

IV. Syphilis
  Certain (i.e., spirochetes found)
  Probable
  Possible

V. Maternal Diseases
  Chronic renal
  Cardiac
  Tuberculosis
  Pneumonia, bronchitis, empyema
  Intestinal obstruction
  Epilepsy
  Others

VI. Placental States
  Excessive red or white infarction
  Retroplacental hematoma
  Other placental degenerations
  Excessively small placenta

VII. Fetal States (excluding syphilis)
  Hydrocephalus
  Anencephaly
  Spina bifida
  General edema of the fetus
  Other deformities
  Multiple pregnancy
  Hydramnios
  Others

VIII. Prematurity

IX. Cause Unknown

X. Deaths Due to Postnatal Causes

XI. Insufficient Information

XII. Non-viable Cases

Following the above classification the causes of death at the Long Island College Hospital may be summarized thus:

TABLE I

Cause	Number	Per cent
I. Complications of labor...........	12	30.7
II. Antepartum hemorrhage..........	4	10.3
III. Toxemia.....................	3	7.7
IV. Lues:		
Certain.....................	0	0
Probable....................	3	7.7
Possible....................	8	20.4
V. Maternal disease..............	1	2.6
VI. Placental States.............	1	2.6
VII. Fetal states.................	3	7.7
VIII. Insufficient information.........	4	10.3
Total....................	39	100.0

The outstanding fact in this summary is that the greatest single cause of fetal death is the complications of labor. This finding agrees with that of all authors who have written on the topic. One notices that not a single case of certain syphilis is recorded. A death can be ascribed to syphilis with certainty only if the Spirochaeta pallida is found in the tissues of the infant. Since the organism was not sought for in this series, certainty is not warranted. Death was ascribed to probable syphilis when the mother had a positive Wassermann with a history of repeated miscarriages. Possible syphilis was ascribed to cases in which the pathology of the placenta or the obstetrical history of the mother pointed to syphilis. The Wasserman in these 8 cases was negative in 7 and not recorded in the other.

One is impressed by the large percentage of cases in which the cause was not determined; these were classed under "Insufficient information" because autopsy studies, if done, with a search for the Spirochaeta pallida would have made possible the proper classification of most of these cases. Only one autopsy was done in the entire series. The pathological report regularly contained the statement "fetus macerated, autopsy not done." But as Ballantyne[1] points out, maceration is the basis of the study of antenatal pathology. "The custom of saying that because the foetus was macerated there was no use in examin-

ing it microscopically or bacteriologically must be abandoned." The absence of autopsy findings in the present series will make it necessary to base the discussion on pathology entirely on the literature.

Before proceeding to a detailed consideration of the individual cases in this series it is well to point out the information desired in each case. Holland[3] and Thomson[4] have both given lists of data desired, of which the following is a compendium:

I. With Reference to the Mother.

1. Age, and whether married or single
2. Enquiry into economic conditions
3. History of previous health, with special reference to infection with syphilis or gonorrhea
4. Previous obstetrical history
5. Health during present pregnancy
6. Duration and type of present labor
7. Wassermann reaction
8. Gonococcal complement-fixation reaction

II. With Reference to the Father.

1. History of health with special reference to infection with syphilis or gonorrhea
2. Wassermann reaction
3. Gonococcal complement-fixation reaction.

III. With Reference to the Fetus.

1. Description of the naked-eye appearance of the cadaver and its organs, with notes of weight ratios and measurement, and calculation of the fetal age from the centers of ossification
2. Examination of the cranium with special reference to tears of the dural septa, and to hemorrhage into the lateral ventricals
3. Preparation of sections of the viscera for histological examination
4. Examination of the principal organs by the Levaditi method for the Spirochaeta pallida
5. Naked-eye and microscopical examination of the placenta with record of weight-ratio and notes upon the condition of the umbilical cord and membranes.

Most of the data called for in an ideal study of fetal death will not be found in the following cases.

SUMMARY OF CASES

Case I (Hospital Case No. 49.) Death due to *premature rupture of membranes.* Mother,

aged forty-two, admitted with diagnosis of nephritic toxemia. Four other children living and well. Blood pressure, systolic, 190, diastolic, 94 at delivery. Treated before delivery with magnesium sulphate and milk diet. Wassermann was negative. The position was right occipitoposterior. The membranes ruptured on January 3, 1926 at 11:00 A.M. Pains began on January 6, 1926, at 1:00 A.M. By 2:00 A.M. pains were coming every five minutes. Much meconium appeared, though the fetal heart was still heard. At 3:45 A.M., the infant was born dead, apparently asphyxiated for some time. The toxemia in this case seems to have had nothing to do with the death of the infant.

Case II. Death due to *transverse presentation.* Mother, aged forty-one with one child living and well, and one miscarriage at seven weeks admitted with diagnosis of right scapuloanterior. At 8 A.M. the fetal heart was heard. At 10:15 A.M. the cord prolapsed, the fetal heart still being heard. At 10:30 A.M. an attempt at replacement failed. Version was attempted and the foot pulled down. The fetal heart was not heard. A retraction ring was formed. A cesarian section with hysterectomy was done. Pathological examination of the uterus showed a partial placenta previa, acute amniotis, acute decidual endometritis, and mural lymphangitis. Here, despite the numerous complications, death of the fetus may be ascribed to the abnormal presentation.

Case III. (Hospital Case No. 439.) Death due to *transverse presentation.* Mother, aged forty, was a septipara, with two miscarriages. Signs pointed to nephritic toxemia and polyhydramnios. Albumen was present in the urine and the blood pressure was systolic 140, diastolic 80. The position of the child was right scapuloanterior.

The membranes were ruptured, version done and followed by extraction. Death was ascribed to the malposition.

Case IV. (Hospital Case No. 243.) Death due to *breech presentation.* Mother, aged twenty-two, primipara, position was left sacroposterior. Extraction was done on the indication of an irregular, slow heart.

Case V. (Hospital Case No. 319.) Death due to *breech presentation.* Mother, aged twenty-four, primipara. Position was left sacroposterior. Up to 6:30 P.M. the fetal heart

was heard. At 7:55 P.M. Pinard's maneuver was done. A loop of coil around the left leg was found. The fetal heart became slow and irregular. The infant was extracted but could not be resuscitated.

CASE VI. (Hospital Case No. 581.) Death due to *breech presentation*. Mother, aged twenty-six, was a tripara; the position was right sacroanterior. The fetal heart was irregular on delivery. Pathological study shows atalectasis and congestion of lungs and diffuse round cell infiltration of the liver. There is insufficient data to allow of definite disposal of this case, although it most probably belongs under complications of labor, death being ascribed to the breech presentation.

CASE VII. (Hospital Case No. 518). Death due to *coil around neck*. Mother, aged seventeen, primipara. The position was left occipito-anterior. The fetal heart was slow during the first stage and was lost with the cervix dilated 4 cm. A coil around the neck was accepted as the explanation of the asphyxia.

CASE VIII. (Hospital Case No. 629.) Death due to *complete twists in cord*. Mother, aged twenty-five, primipara. No evidence of syphilis or toxemia. Baby was born on October 7, 1926, and the fetal movements had not been felt since August 2, 1926. The infant was macerated, and a brown fluid with an offensive odor was discharged. The cord showed 19 complete twists, which was accepted as the cause of death. The placenta measured 14.5 by 9 by 0.8 cm. The membranes were gray-brown. Zonal infarcts were present on the amniotic surface and old infarcts on the maternal surface. The cord was brownish and edematous. Microscopically there was sclerosis of the villi. Syphilis cannot be ruled out with certainty in this case.

CASE IX. (Hospital Case No. 655.) Death due to *true knot in cord and one coil around neck*. Mother, aged forty-two, primipara. The fetal heart was heard up to full dilatation. It was slowed by application of the abdominal binder, which was therefore removed. After one and one-half hours on the perineum the fetal heart was lost, low forceps were applied and at birth the condition described above was found.

CASE X. (Hospital Case No. 706.) Death due to *prolapse of cord*. Mother, aged thirty-five, admitted gonorrhea and pelvic inflammatory disease. She had one living child, and had had two miscarriages twelve and six years ago at three and six months. The position of the baby was right occipitoanterior. The fetal heart was heard up to a 5 cm. dilatation of the cervix, when the cord prolapsed. The cord was reposited, but the fetal heart was not heard. Low forceps were applied.

CASE XI. (Hospital Case No. 334.) Death due to *prolapse of cord*. Patient, aged forty, quintipara. The position was right occipito-posterior. There was a complicating marginal placenta previa which seems not to have affected the course of events. The cord prolapsed when the cervix was 2 cm. dilated. In one-half hour 2 loops prolapsed again and the fetal heart was no longer heard.

CASE XII. (Hospital Case No. 408.) Death due to *contracted pelvis*. Mother, aged eighteen, primipara, had simple flat pelvis. There was also evidence of nephritic toxemia but this did not affect labor. The position was right occipitoanterior. After the cervix was fully dilated for two hours the fetal heart became irregular and then stopped. Low forceps was done.

CASE XIII. (Hospital Case No. 62.) Death due to *accidental hemorrhage*. Mother, aged forty-three, has had fourteen children, of which only three are living. She was five months pregnant. Onset was with pain over the pubes and profuse vaginal bleeding, later with cessation of the pain. A vaginal pack did not help. A Braxton-Hicks version was done and followed by extraction. A discharge of old blood followed this. The uterus was packed. The fetus measured 36 cm. and was grossly normal. The placenta was discoid in shape and measured 15 by 13 by 0.5 cm. The fetal surface was normal and the cord laterally inserted. Cord and membranes were normal. Microscopically the amnion was normal. Subjacent to the chorion was a broad hemorrhagic zone of recent origin. This zone was inter-villous. The villi had only the syncytial layer of epithelium. There were a few Hofbauer cells. On the maternal surface was a red infaret. The villi had undergone advanced degeneration and were matted by fibrin. The pathological diagnosis was: (1) subamniotic hematoma; (2) red infaret; (3) congestion.

CASE XIV. (Hospital Case No. 192.) Death due to *placenta previa*. Mother, aged thirty-three, with one other child, was brought in an ambulance because of painless hemorrhage. The fetal heart was heard on admission. A Braxton-Hicks version was done. The child was delivered in a spontaneous right sacro-anterior presentation, but was dead. The membranes at the margin of the placenta were torn from the surface. At one margin there were numerous torn cotyledons and peripheral blood vessel clots.

CASE XV. (Hospital Case No. 462.) Death due to *placenta previa*. Mother, aged thirty-five, nonipara. Diagnosis of marginal placenta previa was made. The insertion of an extra-ovular bag did not help. The fetal heart was heard until version was done. It then became irregular and after two hours ceased.

CASE XVI. (Hospital Case No. 603.) Death due to *placenta previa*. Mother, aged thirty-eight, duipara. In this case as in the previous one the fetal heart was satisfactory until version was done. It then became irregular and after one hour was lost.

CASE XVII. (Hospital Case No. 29A.) Death due to *eclampsia in mother*, who was a primipara aged twenty. The patient was admitted in coma. Her Wassermmann was negative. Blood pressure was, systolic 212, diastolic 100, and the urine boiled solid. The fetal heart was not heard. The patient delivered a macerated, premature infant. The cord was centrally inserted. The placenta was congested but showed no special pathology. There were no infarcts.

CASE XVIII. (Hospital Case No. 206A.) Death due to *preeclamptic toxemia*. Mother was a primipara of thirty-eight. She had had two miscarriages four and six years ago at three and six and one-half months. The fetal heart was not heard. Patient delivered a seven-month macerated infant. One portion of the placenta near the periphery was normal. The rest was smooth. There were 2 infarcts. The cord was inserted eccentrically.

CASE XIX. (Hospital Case No. 337.) Death due to *toxemia of mother*. Mother, aged thirty, with a history of one other child also born dead, and of three miscarriages at three months, was admitted with a diagnosis of toxemia. The Wassermann was negative. Blood pressure was systolic 140, diastolic 106. The fetal heart was not heard. The patient delivered a premature, macerated infant. The placenta was eccentric and had numerous areas of fibrosis. In this case syphilis has not been positively ruled out.

CASE XX. (Hospital Case No. 495.) Death due to *syphilis*. Mother, aged twenty-three, with one other child, gave a history of a 3 plus Wassermann. She had felt no fetal movements for one week. The patient delivered a seven-month macerated infant. The placenta was heavy, friable and whitish. The cord was eccentrically inserted.

CASE XXI. (Hospital Case No. 514.) Death due to *syphilis*. Mother, aged twenty-two, with one other child. Wassermann on one occasion was 3 plus, another time was negative, and at a third test was 3 plus. The mother had felt no fetal movements for three days. The patient delivered a seven-month, macerated infant. The placenta was friable, the cord eccentrically inserted.

CASE XXII. (Hospital Case No. 634.) Death due to *syphilis*. Mother, aged twenty-four, had following obstetrical history: 1 stillborn at term, 1 stillborn at 6 months. 1 premature living and well, and 1 full-term died in two days. The first Wassermann was negative but on reexamination was 4 plus.

CASE XXIII. (Hospital Case No. 236). Death possibly due to *syphilis*. Mother, aged thirty, had one living child eighteen months old, but has had no miscarriages. She has had gonorrhea. Wassermann was negative. The fetal heart was not heard. The patient delivered a six-months macerated fetus. The placenta was normal only in a very small portion. There were many infarcts which studded the entire placenta. The presence of gonorrhea and the absence of any other competent producing cause points to syphilis as the cause of death in this case.

CASE XXIV. (Hospital Case No. 421). Death possibly due to *syphilis*. Mother, aged thirty-three, quadripara, had had three miscarriages at three months. The Wassermann was negative. The patient delivered a seven-month, macerated fetus. The placenta had degenerated cotyledons. The cord was eccentrically inserted. The series of miscarriages points to syphilis,

but the diagnosis could have been made more certain by more data.

CASE XXV. (Hospital Case No. 459). Death possibly due to *syphilis*. Mother, aged twenty-six, has had 4 other deliveries as follows: 2 full-term infants died in five days, 1 full-term stillbirth, 1 miscarriage at five months. The Wassermann was negative, but patient had had gonorrhea ten years ago. Systolic blood pressure was 110 mm. and the urine was negative. No fetal movements were felt for five days. At delivery an impacted right occipito-posterior presentation required manual rotation of the head and shoulders. The infant was stillborn and macerated. The history in this case is very suspicious of syphilis despite the negative Wassermann.

CASE XXVI. (Hospital Case No. 488). Death possibly due to *syphilis*. Mother, aged twenty-one, was a primipara who admitted gonorrhea and was not sure about not having had syphilis. The Wassermann was negative. For one week prior to delivery the patient had a brownish vaginal discharge, but no malaise or headache. She delivered a seven-month, macerated infant. The placenta measured 17 by 12 by 1 cm. The membranes were dull, prominent, and lusterless. Microscopically the amnion was seen to be poorly preserved. The sub-amniotic stroma was edematous. The villi showed sclerosis of the main-stem branches. Budding was prominent, the buds being small, knob-shaped, and sclerotic. The stroma was edematous. The pathologist did not make a definite diagnosis, but the history and pathological findings point to syphilis.

CASE XXVII. (Hospital Case No. 542). Death possibly due to *syphilis*. Mother, aged twenty-nine, had had one other baby, also stillborn and macerated. Patient also had pyelitis. The fetal heart, according to the record, was heard on admission but was lost during the first stage. The fact that the patient delivered a macerated fetus (six months) makes it doubtful whether the fetal heart was really heard. Syphilis is indicated as the possible cause of death on account of the history. There is no record of a Wassermann.

CASE XXVIII. (Hospital Case No. 705). Death possibly due to *syphilis*. Mother, thirty-four had had 3 miscarriages and 1 other stillborn infant. The Wassermann was negative; blood chemistry was negative; systolic pressure was 114 mm.

Patient delivered six months macerated infant with a bilateral hare-lip. The placenta showed some infarcts and fibrous cotyledons. The membranes were gray-brown. The cord was eccentrically inserted. Microscopically there was sclerosis of the villi with few vessels. The decidua compacta was fused in one area with villi. History and pathology point to syphilis.

CASE XXIX. (Hospital Case No. 726). Death possibly due to *syphilis*. Mother, aged twenty-six, has had three other macerated infants, one at five months, two at seven months. The Wassermann was negative. There was no fetal heart beat on admission. Patient delivered premature, macerated infant. The placenta measured 17 by 12 by 1 cm. and was hemorrhagic in spots, though mostly pale. The cord was centrally inserted. The maternal surface was gray-white. Microscopically the amnion appeared well preserved. The amniotic stroma was edematous and infiltrated with neutrophiles. The chorionic villi were large and club-ended, the stroma edematous and sclerotic, and the blood vessels sclerotic. There was congestion of the decidual vessels. The pathological diagnoses of acute amniotitis and sclerosis of the villi (possibly lues) were made.

CASE XXX. (Hospital Case No. 774). Death possibly due to *syphilis*. Mother, aged twenty-six, had had three miscarriages and probable history of gonorrhea. There was a trace of albumin in the urine and the systolic blood pressure ranged from 128 to 140 mm. A diagnosis of nephritic toxemia was entered on the chart. The patient delivered a five-month macerated infant. There was a placenta marginata with an eccentrically inserted cord. The amnion was brownish and there were no infarcts. Microscopically the amniotic epithelium was not preserved. The underlying stroma was edematous and the veins thrombosed. The villi were sclerosed with subintimal thickening of blood vessels, which were few. There was an edema and hydropic degeneration of the decidual cells. The cord was edematous. The history and pathological findings point to syphilis as a more probable cause of the stillbirth than toxemia.

CASE XXXI. (Hospital Case No. 711). Death due to *renal disease in mother*. Mother, aged thirty-five, octipara had nephritic toxemia and a single kidney. The fetal heart was not heard

before labor. The patient delivered a seven-month infant.

CASE XXXII. (Hospital Case No. 145). Death due to congenital malformation. Mother, aged thirty-six, sextipara. The fetal heart was lost in the first stage. The child had acrania-acepalus.

CASE XXXIII. (Hospital Case No. 189A). Death due to *congenital malformation*. Mother, aged seventeen, was a primipara. The membranes were supposed to have ruptured three weeks before admission. The fetal heart was not heard. The infant when born was hydrocephalic and had club-feet. It may be that the early rupture of the membranes was responsible for the malformations, but the data on the chart is too scanty to permit an opinion. Death is therefore ascribed to the malformation.

CASE XXXIV. (Hospital Case No. 206). Death due to *congenital malformation*. Mother, aged thirty-one, was a duipara. The fetal heart was not heard. The position was right sacroanterior. The fetal body was delivered up to the neck. The after-coming head was hydrocephalic and had to be perforated. The head was further malformed having small eyes and a single nostril. The Wasserman in the mother was negative.

CASE XXXV. (Hospital Case No. 271). Death due to *retroplacental hematoma*. Mother, aged thirty-three was a tripara. The Wassermann was negative. Labor was induced by a No. 5 Voorhees bag and the patient was delivered of a four and one-half-month infant of 22 cm. in advanced maceration. The placenta was ovoid and measured 18 by 12 by 2 cm. The cotyledons were well formed, but the adherent compact layer of decidua lent a gray-white appearance to the surface. The membranes were dirty-brown and also covered with decidua. The fetal surface had a large central hematoma measuring 7 by 5 cm. and projecting 5 to 6 cm. beyond the surface. The hematoma was discrete from the chorionic substance. Microscopically the amniotic epithelium was normal. The subjacent stroma was edematous. The hematoma was fused with this layer but extended into the chorionic substance separating the villi, which were well preserved. The villi were frequently fused by fibrinoid deposits. The hematoma was sufficient cause for the death of the fetus, though, of course, the real problem is to find the cause of the hematoma.

CASE XXXVI. (Hospital Case No. 622). Cause of death *unknown*. Mother, aged thirty-six, was a primipara. Wassermann was negative and the blood pressure systolic 140, diastolic 60. The fetal heart was heard three days prior to admission but not on admission. A full term macerated fetus was delivered. The placenta had a greenish hue, was thin, fibrous, and granular and had few small infarcts. There was insufficient data to determine the cause of death.

CASE XXXVII. (Hospital Case No. 660). Cause of death *unknown*. Mother, aged thirty-six, was a primipara. The Wassermann was negative; the urine had a trace of albumin; the blood pressure was systolic 140, diastolic 96. The position was right occipitoanterior. The fetal heart was last heard over two weeks before admission. The infant was macerated; it measured 42 cm. and weighed 2400 gms.

CASE XXXVIII. (Hospital Case No. 758). Cause of death *unknown*. Mother, aged twenty-four, was a tripara. She was admitted by ambulance, with bleeding and spasmodic uterine contractions. There was a foul, brownish vaginal discharge. The patient had bronchitis and fibrinous pleurisy. The Wassermann was negative. The patient delivered a six-month, macerated infant. Death could hardly be ascribed to the bronchitis, since the fetus was macerated and must have been dead for some time. There is not sufficient data to permit a diagnosis.

CASE XXXIX. (Hospital Abortion No. 4). Cause of death *unknown*. Mother, aged twenty-two, had one other child living and well. She had a papular rash over the chest which was diagnosed as a possible chicken-pox. She delivered a seven month, macerated fetus. The maceration makes it probable that the acute condition was not the cause of the fetus' death.

A comparison of the findings in this series with the results of various workers in America and Europe reveal a remarkable similarity of results. Complications of labor stand out in almost every series as the most important single cause of fetal death. The significance of syphilis is interpreted variously. Thus Holland and the English workers think that syphilis as a cause of

fetal death has been overemphasized, while Williams of Johns Hopkins finds it of paramount importance. He admits that the large proportion of negroes in this series explains this difference. In the present series syphilis appears to be a more potent factor than in many other series, except those of Williams. However, so many of the cases in this series are unproven cases that conclusions should be made with great caution.

The following summary table allows of immediate comparison of the results of all workers which permit tabulation. Other results will be recorded separately.

TABLE III
PERCENTAGES OF DEATH (WILLIAMS, 1915)

Cause	Percentage
Syphilis	26.4
Dystocia	17.6
Various	11.2
Prematurity	7.1
Toxemia	6.5
Deformity	3.4
Inanition	3.3
Antepartum hemorrhage	4.9
Other causes	1.6
Cause unknown	18.0

One notes here the high figure for syphilis, which is almost exactly that of the present series. In a later study,[8] Williams analyzes

TABLE II
PERCENTAGES OF DEATH BY CAUSES

	This Series	Holland[3]	Holland and Lane-Claypon[2]					Williams[7] (whites only)	Holt[5]	McQuarrie[6]	Thomson[4]
			London	Glasgow	Liverpool	Edinburgh	Cardiff				
I. Complications of labor	30.7	28.3	34.8	40.2	31.2	37.2	30.2	22.4	31.1	37.1	23
II. Antepartum hemorrhages	10.3	22.3	21.7	30.7	14.3	10.5	17.0	9.9	7.4	2.0	6
III. Toxemia	7.7	8.6	12.7	10.7	7.7	10.2	20.1	11.7	9.9	9.2	6
IV. Syphilis	28.1	15.3	7.7	7.0	8.6	11.1	8.5	12.8	8.3	15.5	15
V. Maternal diseases	2.6	.... 8.6	5.9	2.5	2.0	1.5	0.8	.... 17.2	.... 23.8	.... 5.2	12
VI. Placental states	2.6		0.9	0.0	2.0	1.7	1.5				6
VII. Fetal states	7.7	5.6	5.0	5.4	23.6	7.2	10.8	6.6	3.0	8.2	23
VIII. Prematurity	9.0	0.3	0.0	0.3	2.0	10.4	3.1	5.2	2.8	5.3	6
IX. Cause unknown	10.3	10.7	11.3	3.2	8.6	10.2	8.0	14.3	13.7	17.5	5

In estimating the significance of these figures one must remember the personal equation in assigning the cause of death to a given case. Thus the workers in Edinburgh assign 10.4 per cent of deaths to prematurity, while the workers in London found no cases due to prematurity. Such a discrepancy is probably in great part due to different opinions on similar cases.

The figures for the Williams cases given in Table II are only for whites. His full figures for whites and blacks in his 1915 series[7] of 700 fetal deaths follows:

the significance of syphilis as a cause of fetal death in greater detail. The following table is a summary of his 302 cases:

TABLE IV
PERCENTAGE OF DEATHS (WILLIAMS, 1915)

Cause	Per cent
Syphilis	34.44
Dystocia	15.20
Toxemia	11.55
Prematurity	10.59
Antepartum hemorrhage	13.89
Deformity	3.64
11 other causes	10.69
Cause unknown	8.61

Analyzing these figures according to whites and blacks, Williams found that syphilis was the cause of death in 12.12 per cent of the white cases and 45.23 per cent of the black. The incidence of syphilis among the whites was 2.48 per cent and among the blacks 16.29 per cent.

Cruickshank,[9] in a discussion of syphilis as a cause of antenatal deaths, believes it to be an important cause of death in the later months of pregnancy and not in the early months.

A comparison of the figures of different workers on syphilis is very difficult because the factor of treatment has not been analyzed. Thus it is not stated what percentage of syphilitic mothers in England received antenatal care and treatment as compared with the less tractable negro patients in Baltimore and Brooklyn. It is probable that syphilis is losing its importance as a cause of fetal death in England only because of the excellent antenatal care in practice there, and the low percentages reported should not be taken to mean that syphilis kills less babies than was once believed.

The importance of the antenatal care in syphilis becomes evident from analyses by Ballantyne[1] in England and Williams[8] in America. The former found that among 138 syphilitic mothers who were treated there were 7 stillbirths, a death rate of 50.7 per 1000, while among 33 syphilitic mothers not treated there were 20 stillbirths, a rate of 606 per 1000. Williams studied 421 cases with a positive Wassermann reaction; of these, 157 received no treatment, with the result that 52 per cent of the offspring were stillborn or syphilitic; 103 received inadequate treatment (2 or 3 injections) with 37 per cent dead or defective offspring; 163 received full treatment (4 to 6 injections) with 7.4 per cent of fetal syphilis.

With this evidence we close our discussion of syphilis as a cause of fetal death and turn to the other great single cause, the complications of labor.

As has already been indicated, Holland has especially emphasized the latter factor.

The question arises here as to how these complications act to produce death. To what extent are the deaths preventable by more careful practice of the art of obstetrics? Holland[2] presents some significant data. He studied at autopsy the presence and nature of tentorial tears and compared the presence of tears with the amount of obstetrical operative procedure in each case. The following table summarizes his results:

TABLE V

PERCENTAGE OF TENTORIAL TEARS IN RELATION TO PRESENTATION AND METHOD OF DELIVERY (HOLLAND, 1926)

Presentation	Delivery						Total
	Spontaneous	Forceps		Version	Version and forceps	Cesarian section	
		Once	More				
Vertex anterior	16 3	55 3	52 2	28 0	63 6	16 6	24 6
Breech	50 6	66 6		40 0		. .	55 7
P O P	33 3	44 4	80 0		66 6	. ..	50 0
Face	33 3	66 0		50 0		. .	36 8
Transverse				37 1	100	50	35.7

One is at once impressed by the increase of tentorial tears with increased operative procedures, and by the great percentage of tears in breech presentations. The conclusions of Holland on these observations bear quotation:

The frequency of intra-cranial lesions is high. Tentorial tears were noted in just over $\frac{1}{4}$ of all cases of fresh and neo-natal deaths in the entire series. Of these some were due to spontaneous breech labour, with, in some cases, difficulty in the delivery of the arms or head; but the majority were associated with the use of forceps or with the practice of podalic version.

Although it is impossible to ascertain the precise factor which extinguished the life of the foetus or child it can hardly be doubted that the intra-cranial lesion with its accompanying hemorrhage was at least an important contributory cause of death. It appears therefore, that a high proportion of intra-natal mortality is due to manipulation of some kind or another. Such manipulation is often necessary in the interests of the mother or the child, but the present inquiry suggests that efforts should be directed toward the reduction of the need for obstetric interference.

Browne[10] arrives at conclusions similar to those of Holland. He found that cerebral hemorrhage occurred 10 times as frequently in breech presentations as it did in vertex presentations, and in the latter it is associated in most cases with the use of forceps.

Lyon[11] in a recent paper also emphasizes complications of labor as a cause of fetal death. His presentation of data, however, is so complex as to challenge all efforts at analysis.

The high proportion of tentorial tears in breech presentations leads Holland,[12] to suggest that as long as 10 minutes be allowed for the delivery of the head in breech cases.

THE PATHOLOGY OF FETAL DEATH

Two phases of the pathology of fetal death present themselves for analysis. The first is the nature of fetal death, the factors operating to cause the cessation of fetal life; the second is the nature of the changes going on in a dead fetus, or the process of maceration.

Of the first phase of the problem little can be said because little is known. The cause of fetal death in maternal toxemia, for example, is according to McIlroy[13] unknown. Strachnan[14] describes hemorrhagic lesions of the placenta associated with toxemia. These lesions are initiated by uteroplacental hemorrhage which produces sudden vascular injury. This gives rise to acute dilation of the chorionic blood vessels. The villi enlarge and the chorionic vessels rupture, giving the red infarct, which with time changes to the white infarct. These infarcts and intraplacental hemorrhages characterize toxemia as against syphilis, where according to Strachnan[15] there is neither infarction nor hemorrhage. To ascribe the fetal death in toxemia to placental insufficiency following these changes is not warranted, since there is no knowledge of what direct effect the poisonous products of toxemia (whatever they may be) have on the fetus. Holland[3] describes a toxemia neurosis of the liver, kidneys and other organs of the fetus in eclampsia. Similar findings are also described by Browne[10] while Thomsen[4] finds a congestion of the organs with small petechiae in the viscera.

The pathology of fetal syphilis is discussed in such detail in all textbooks that it will be dealt with very briefly here. The most important point seems to be to emphasize the value of a routine search for the Spirochaeta pallida in the tissues of the infants. The pathology of the placenta is well known. Browne[10] brings out the fact, which he says is little known, that in congenital syphilis enlargement of the spleen is a much more constant sign than enlargement of the liver. In the viscera the microscopic picture is that of an increase of the normal interstitial tissue. These changes are to be sought for in the thyroid, thymus, lung, pancreas, and other viscera, as well as in the liver and spleen.

We now proceed to a discussion of maceration, which, as Ballantyne points out, is the basis of fetal pathology. Maceration is not peculiar to syphilis. It is the method of degeneration of the tissues of the fetus under the aseptic conditions within the uterus, no matter what the cause of death. With this opinion there is unanimous agreement. Maceration is one of the most striking examples of autolysis, a process whereby the tissues are broken down by enzymes contained in the cell-bodies themselves. It is a process exactly similar to the changes occurring in the living body in cases of brain infarcts or tumors with central softening (Thomsen[16]).

In the present series maceration occurred in 19 cases out of the 39, divided by cause of death as follows:

TABLE VI

Causes of death	No. of cases
Syphilis	12
Toxemia	2
Retroplacental hematoma	1
Cord with twists	1
Unknown	3

Thomsen,[4] Strachnan[15] and Holland[2,3] also find maceration in cases due to numerous causes of death. The only common feature is that the infant should have been dead for some time, because, as Ballantyne[1] points out, if the death has occurred only a day or two before labor and birth, the macerative process may be so slight as to be unrecognized.

No description of maceration in the recent literature equals in clarity and conciseness that of the pioneer in this problem. The following description of maceration, written by Ballantyne[17] in 1902, has had very little added to it in twenty-five years.

The external appearance and the internal alterations of the macerated foetus vary with the period which has elapsed since death. The process consists in a gradual softening of the tissues of the body without the development of putrefactive gases or the presence of microbes; it is an aseptic change. It used to be termed "putrefaction" by the older authors, but that name ought to be restricted to the cases in which putrefactive germs have gained access to the interior of the uterus and set up true putrefaction.

In the first stage of maceration which corresponds with the first 10 or 12 days following intra-uterine death, the external form of the foetus is hardly modified, and the parts retain their firmness. The epidermis here and there (limbs, neck etc.) is raised up into blebs containing blood stained serum; some of these may have burst and their contents passed into the liquor amnii to mix with it, and with the meconium in it. In the body cavities there is found a more or less clear serum, and the organs are somewhat soft; the subcutaneous tissue is infiltrated with serum, and the brain shows some softening, especially in the gray matter.

In the second stage, tenth day to fortieth, the macerative changes have become very marked. At this stage the whole foetus is somewhat swollen, but on account of its softness tends to flatten out on any hard surface upon which it may be laid. The abdomen, in particular, flattens out, as does the head in an antero-posterior direction. The epidermis is absent over nearly the whole surface of the body, leaving the dull red underlying skin fully exposed. On the scalp, however, it is attached.

The cranial bones move freely on each other, and the scalp tissues are swollen and infiltrated with serosanguinolent fluid, which may accumulate, especially at the vertex, and produce a spurious caput. Everywhere there is found this sero-sanguinolent fluid in the subcutaneous tissue, between the muscles, in the abdomen, in the thorax; so constant and so copious is it that C. Ruge gave the name hydrops sanguinolentus to the foetus in this stage of maceration, and the name was quite warranted, although it came erroneously to be regarded as equivalent to the syphilitic dead foetus. All the internal organs show softening and the brain is quite diffluent, only maintaining its form by the help of the surrounding membranes. The heart, the liver, the spleen, and the lungs are all more or less altered in shape on account of their softness; they may be pale in colour, or stained to a greater or less degree with blood. Under the microscope the epithelial elements of the tissues can be recognized as swollen and granular or fatty in appearance; the changes in the stroma of the organs are little known and the blood corpuscles may be found swollen and paler in colour than normal, or else shrivelled and broken up into granular masses. The colouring matter of the blood is dissolved in the fluids of the body cavities, or lies as small crystals in the tissues. During the second stage of maceration the histological elements of most of the organs and tissues become unrecognizable. In the third stage, which lasts, according to Lempereur, from the 40th to the 60th days of intra-uterine retention, the cellular elements of even the lungs are unrecognizable. The absence of the epidermis is now complete and is seen even on the hairy scalp; the softening of the body is very marked; the internal organs rest in a collapsed state upon the vertebral column; and the brain is simply an "emulsion of nerve tissue."

Thomsen[16] describes an edema of the scalp and scrotum. The placenta is dull, due to edema, and the cord also has an edema of Wharton's jelly. Microscopically there is an increase of lecithin and a granularity of the cytoplasm which is distinct from the granularity of cloudy swelling, the latter being a process occurring in living cells. The cells later undergo swelling and a loss of the cell outline. The nucleus undergoes caryolysis.

Thomsen further brings out that maceration, similar to other autolytic processes, takes place in an acid medium. Normally the liquor amnii is alkaline or neutral. As maceration advances and the large sero-sanguinous bullae rupture, they discharge their acid contents into the liquor, thus favoring further autolysis. The state of metabolism also seems to affect maceration, since the more premature the fetus, the more rapid the maceration.

Strachnan[15] emphasizes the point that the bone changes in maceration resemble the chondroepiphysitis of syphilis, and that care should be exercised in using this sign for the diagnosis of fetal syphilis.

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THE PRACTICAL APPLICATION OF LOCAL ANESTHESIA IN MAJOR SURGERY*

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CINCINNATI

So much literature has appeared recently concerning the use of local anesthesia in major surgery, that I think we should try to analyze the various drugs and methods used in the abolition of pain sensation in a chosen region, and attempt to place or limit them, as the case may be, within their respective fields. Dr. R. E. Farr, in a recent article, advised that almost every abdominal operation be performed under local infiltration, while other surgeons restrict its use to a comparatively limited field of minor surgery or in exceptional cases where ether or its combinations are contraindicated.

As in other things, there must be a happy medium, and it is this which I shall attempt to find; I believe that when it is found it will serve a twofold purpose: on the one hand, to the surgeon in overcoming the confusion which now exists in his mind as to which method to choose; on the other, to the patient, in eliminating painful procedures when local anesthesia is not advisable, or unnecessary etherization when general narcosis is not justifiable.

EVOLUTION OF ANESTHESIA

The important steps which made possible local anesthesia as it is employed at the present time were the introduction of cocaine by Koller in 1884; the procedure of infiltrating the tissues with weak anesthetic solutions initiated by Schleich; and the discovery that infiltration of cocaine into or around a nerve trunk in any part of its course effectively blocked the area supplied by that nerve. With these three discoveries it was thought possible that local anesthetics would soon entirely supplant general anesthetics in their application to major surgery.

But we had overlooked other features; insensibility to pain is not the only requisite to be desired, but we must also obtain sufficient muscular relaxation to insure the proper performances of the procedures contemplated; and not alone this, but it was soon discovered that not every operator possessed the necessary experience and skill in the use of local anesthetics. In other words, surgeons who had become accustomed to working on the anesthetized patient could not readily adapt themselves to the delicate technique and patience required in the successful performance of surgery under local narcosis.

The difficulties encountered have led many surgeons to discard local anesthesia almost entirely and continue with the use of general narcosis in almost every case. With the coming of younger surgeons, however, especially trained in its use, local anesthesia has been given a renewed impetus. Indeed, it is safe to say that fully 50 per cent of all operations performed at the present time under general narcosis could be satisfactorily performed under local anesthesia intelligently used. Whether or not this is to be desired, I shall try to show presently.

METHODS AND DRUGS EMPLOYED FOR LOCAL ANESTHESIA

At the present time two methods of producing local anesthesia are generally used: (1) agents which freeze the tissue and (2) chemical analgesics such as cocaine and its substitutes.

We shall not consider the first, of which

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ethyl chloride is a type. Of the second, cocaine, novocaine (procaine), apothesine, stovaine, and quinine and urea, are those most commonly used. Of these, novocaine holds the most important place and has stood the test of time. The repeated comparing of the toxicity of novocaine with that of apothesine, stovaine, etc., may lead the physician to believe that they all have the same anesthetic potency in solution of equal strength. We have used nothing but novocaine during the past eight years and have yet to see a case of poisoning or even idiosyncrasy. It is true that an idiosyncrasy may exist, but this would apply equally to all local anesthetics. The toxicity of apothesine has been rated to be twice that of procaine by the Council of Pharmacy and Chemistry of the American Medical Association.

The combination of quinine and urea was introduced into surgery in 1907. It has several advantages, having no toxic effects as far as is known and producing an anesthesia which lasts from twenty-four hours to four or five days. At the present time the drug is employed in 0.5 to 0.25 per cent solutions. In stronger solutions it has been known to interfere with wound healing.

To sum up, therefore, the clinical dangers cannot be predicted by the use of any one drug, since clinical accidents depend upon idiocyncrasies, or the technique of application. Novocaine 0.5 per cent with 8 drops of adrenalin solution 1:1000 is still our choice.

SUITABLE CASES FOR LOCAL ANESTHESIA

To what extent can local anesthesia be successfully and satisfactorily employed? Many authors and surgeons differ on this question, and therefore we shall try to give a presentation of our own experience.

For the minor procedures, such as exploratory puncture, amputating toes or fingers, circumcision, removal of benign growths such as wens, cysts, lipomata, benign tumors of the breast, or isolated superficial glands, we use local anesthesia entirely, with two exceptions: we never use local anesthesia in inflammatory tissues, and never in cancerous tissues, not only because we cannot induce satisfactory anesthesia in inflamed tissues, but also because we are liable to disseminate the infection or cancer to other parts.

For the greater amount of major work we have become rather skeptical of the efficacy of local anesthesia, after giving it a thorough trial.

During a period of four years I have personally performed over one thousand major procedures under local infiltration, including thyroidectomies, herniotomies (inguinal and femoral), appendectomies (interval and acute), suprapubic cystotomies, rib resections, amputations (Biers' method), cholecystostomies, supravaginal hysterectomies and abdominal explorations. During this period, I tried to preserve an open mind toward anesthesia in order not to prejudice myself with either, and if anything I think I rather leaned toward the local method because I was anxious to see to what extent it could be used.

The result is that I now limit local anesthesia as a routine measure to one major procedure, namely, herniotomy. Local anesthesia is ideal in herniotomy because of the superficial location of the structures involved and the definite position of the sensory nerve trunks supplying the field of operation. I formerly used local anesthesia in all thyroidectomies, but found that even though we had perfect anesthesia, still the patients complained a great deal of strangling as the lobes were being elevated. Occasionally, unless they were deeply narcotized, they became panicky at this stage. While this was the exception, it was a very disagreeable one.

Herniotomies and thyroidectomies were, however, on the whole successful in my hands. By successful I mean that they can be performed thoroughly and painlessly under local infiltration.

From this you would infer that the other operations were not successful. This was

not entirely true. Many of these patients did not complain of any pain, although some did. In others we did not get good relaxation; we could not maintain good exposure because of resistance on the part of the patient. This was especially true in operations upon the upper abdomen and existed from the very beginning of the procedure; whenever a walling-off pad had to be used, there was always the sickening sensation of pulling on the intestines; the interval appendectomies were painless but the readjustment of the bands and membranes, when encountered, was not satisfactory. Inflammatory cases were never satisfactory, for reasons already stated.

For strangulated hernia of any variety, local anesthesia should always be the method of choice. The added strain of general anesthesia upon these patients, already toxic, is frequently more than they can withstand, and there is no need for haste as an abundance of time can be taken to restore the gut of doubtful vitality.

For the majority of abdominal operations, therefore, I would say that local anesthesia is not satisfactory, not because there is any difficulty in entering the abdominal cavity, as this can be very readily done, but because of the various complications that may be present. We know that the abdominal organs are insensible to pain, but the parietal peritoneum is most sensitive, especially when inflamed; and as has been shown, any breaking of adhesions or dragging upon the mesentery is likewise painful. Furthermore, complete relaxation is necessary in abdominal surgery to secure the necessary wide exposure, and this cannot always be obtained under local anesthesia.

Operations about the scrotum, as for varicocele or hydrocele, are all amenable to local anesthesia, as are also many operations about the rectum, such as fissure or thrombotic hemorrhoids. However, when thorough stretching of the sphincter ani is essential, then general narcosis is preferable.

In addition local anesthesia is contra-indicated in children or those greatly excited or hysterical.

ADVANTAGES AND DISADVANTAGES OF LOCAL ANESTHESIA

It must be remembered that I have been using only infiltration methods in recording my above experiences. I have used intraspinal anesthesia in probably fifty instances but always on bad risk cases, such as diabetic or senile amputations, prostatectomies, etc., and have had some gratifying experiences. However, in a number of instances it was necessary to supplement nitrous oxide. While it is my belief and hope that methods will be developed whereby the average surgeon may use intraspinal anesthesia with safety, at present I am skeptical.

Dr. McClintic, in his paper, has claimed that the infiltration method distorts the structures, lowers tissue resistance, distorts chemical equilibrium and slows the process of repair. This has not been our experience. We have certainly performed over 2000 operations with local infiltration at our clinic, and in every instance healing has been commensurate with healing under general narcosis. In fact, I believe that because of the more careful handling of tissues under local anesthesia the healing is cleaner and more rapid.

An argument often brought forward in the presentation of the merits of regional anesthesia is that this method requires the use of less solution than does the infiltration method, with attending decrease in danger from absorption. It is questionable whether this is so. It is not necessary in infiltration to water-log the tissues; and even though a great deal of solution is used, a large part of it runs out through the incision which is made in the edematous tissues, while in the regional method all is absorbed.

I therefore feel that regional anesthesia still has an active competitor in the more practical method of general infiltration. Direct infiltration possesses the advantages of simplicity and speed. It has always

seemed to me that paravertebral or para-sacral anesthesia is a major operation in itself and is not always without discomfort to the patient. It is true that in the hands of the expert, regional anesthesia has a wider application; but ean it be compared in application or safety to a smooth general anesthetic given by a competently trained anesthetist?

Local anesthesia unquestionably has many advantages over general narcosis, especially in thyroidectomies and herniotomies. In the former the postoperative blood changes and the kidney, heart and lung complications are all avoided. Likewise in goiter, the danger of secondary hemorrhage from vomiting is greatly lessened and the patient may be allowed to drink immediately after or even during the operation, thereby allowing a free flushing of the exeretory system.

In hernia also there is a distinct advantage in having the patient conscious, that he may demonstrate the protusion by coughing. There is also less danger of the forcing or breaking of sutures and tearing of tissues from postoperative vomiting, thereby favoring a reeurrence of the rupture.

I cannot see where local anesthesia has any advantages over general anesthesia in the remainder of major surgery, with the possible exception of poor risks. I do not believe that it lessens postoperative pneumonia, which in my experience oceurs in drainage eases where, for some reason or other, drainage has beeome impaired and is of embolic origin. That it lessens mortality is not appreciable. In my opinion the advantages of general anesthesia overbalance the advantages of local anesthesia in major surgery, with the exception of the two procedures mentioned.

THE PREPARATION OF THE PATIENT

The preparation of these patients is important from a psychic viewpoint as well as the physical, and the success or failure of the operation frequently depends upon the preparation up to the time of operation. Nerve calm can usually be assured by prevention of apprehension on the part of the patient and ean be brought about by a good night's sleep before the operation and by reassuranee from the nurse in charge. Morphine grain $\frac{1}{4}$ is given one-half hour before the operation, unless contraindieated. This serves to allay the nervousness on the part of the patient and is also the physiological antidote of eocaine.

In goiter eases where we have an exaggerated type of nervousness, we usually precede the operation with morphine grain $\frac{1}{6}$ and hyosein grain $\frac{1}{200}$. In doing over 100 conseeutive thyroidectomies by this method we never had to resort to general anesthesia.

THE CONDUCT OF THE OPERATION

There are three things which are quite essential to the sueeessful eonduction of an operation under loeal anesthesia: (1) an intelligent appreeiation of its limitations; (2) experience and skill on the part of the operator; (3) knowledge of the sensory nerve supply to the given region.

To attempt to operate any or every case under loeal anesthesia is but to court failure. A nervous, fidgety operator will never find eneouragement in local anesthesia. Coeaine surgery requires a patience and a technique entirely foreign to that of general anesthesia surgery.

The patient should be made as eomfortable as possible upon the operating table. The operating room should be kept as quiet as possible, and especially does this apply to the handling of the instruments. Clean-cut disseetion should be the rule. Rough manipulation, pulling or tearing of tissues is never permissible. Not infrequently, carelessness in observing the slightest details early in the operation eauses restlessness and apprehension on the part of the patient, or even complete demoralization to the point of causing the operation to be discontinued until a general anesthetic has been given.

"Failure" with local anesthetics and condemnation of the method oftentimes results

from neglect in observing these small and apparently trivial details.

SUMMARY

1. Novocaine in weak dilution is still the most efficacious and most reliable drug for use in local anesthesia.

2. I would recommend local anesthesia in all inguinal herniotomies and bad risk thyroidectomies, aside from minor procedures, because in these two procedures local anesthesia has distinct advantages. It is true that with intelligent and skillful use of local anesthesia by one expert in its technique, a great many more major operations can be successfully performed. Furthermore, it must not be forgotten that local anesthesia in a major operation can be used up to the painful part and then nitrous oxide or a small quantity of ether may be given to tide the patient over the painful procedure, a method which is now known as combined anesthesia or anocithesia.

3. Local infiltration is never permissible in infected or cancerous tissues because of the danger of disseminating the infection or cancerous lesion.

4. As with other methods of anesthesia, local anesthesia has its indications and contraindications, its possibilities and its limitations. As has been said, it is especially valuable in thyroidectomies and herniotomies. For other major operations it does not always remove all painful and other disagreeable sensations and it makes demands on the surgeon's time, patience and technique, that all operators are not willing to allow; and only certain patients have the desire or fortitude to remain aware while their operation is in progress.

At one time Matas observed, "It is this tax upon the operator's attention and the vigilance required to keep the inhibitory powers of the patient under control, and the time consumed in the anesthetizing procedure that will prevent cocaine and the local analgesics from gaining ascendency in the crowded amphitheatres of popular teachers where quick and brilliant work is expected by an impatient audience."

SURGICAL ASPECTS OF MEDICAL CONDITIONS*

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NEW YORK

"WHENEVER one studies, even superficially, any generation of men who have acted in the past and of whose actions there is some considerable record, that I think which most strikes the curious student is the nature of the things which were taken for granted during the period."

If we were able to achieve an entirely adequate philosophical detachment, we might be struck with the same wonder in contemplating our own time. However, this is impossible. We are too much a part of it, too much afflicted ourselves with its prejudices and preoccupations to extricate ourselves, save in part.

I do not intend to bore you with more than a suggestion that no doubt other men will marvel at us and the things we take for granted, as we ourselves marvel at the forgotten fashions of a few years ago. Surely if this is true in any field of human thought and activity it is true in medicine.

It would be interesting to catalogue some of the things we take for granted in medicine today. There are a number of them, but this would lead us away from our subject, and I only venture to suggest one: the distinction between medicine and surgery. It is unreasonable; no one really likes it. One would like to be able to say, like Sir Berkeley Moynihan, "I am a physician practicing surgery," but the distinction does exist, and in spite of the growth of many regional specialties, so-called, which profess to cover both the medical and surgical care of certain groups of organs, the physician and the surgeon, whether in general or in special practice, must work together if the patient is to be well served.

I am going to try to discuss rather briefly a few groups of conditions, chosen because they seem to me to typify surgical hazards that arise on the medical side. May I say that I approach this subject with diffidence, not to say trepidation, knowing very well how often the surgical patient needs and craves the kindly skill and wise judgment of the physician and how seldom one hears from the medical ward the cry "Get me a surgeon."

However, I wish to offer for your consideration a group of conditions in which surgery becomes more or less necessary and in which varying factors influence the decision as to the time for operative effort.

I should like to discuss the following groups, not with the idea of covering this large field, which is manifestly impossible in the short time at our disposal, but rather to sketch the outlines of a system of cooperation between physician and surgeon.

SURGICAL ASPECTS OF MEDICAL CONDITIONS

The immediate emergency.
The place of surgical diagnosis.
The timeliness of surgery.
Surgical treatment of symptoms.
The surgical complication.
Surgery in certain toxic states.
The surgical handicap.

THE IMMEDIATE EMERGENCY

The field of activity of the surgeon in medical conditions may be said to consist, first, in those cases in which an emergency arises which demands mechanical intervention—a condition in the natural development of the disease which if allowed to go on uninterrupted will terminate in death or in permanent disability. It is in such conditions as these that vigilance and promptness are most necessary.

*This lecture was delivered on February 25, 1927, N. Y. Academy of Medicine.

160

The immediate surgical emergency comprises:

Hemorrhage.
Embolism and thrombosis.
Spreading infection.
Effusion of fluid under pressure.

HEMORRHAGE. First of all we will consider hemorrhage, which is always a surgical complication if it be within reach. If it is a superficial hemorrhage, its control, as a rule, will be easy, unless it so happens that it is complicated by one of those conditions which interfere with the normal coagulation of the blood.

The methods for the control of hemorrhage need not be discussed here, nor need we linger long over the subject of concealed hemorrhage.

In intracranial hemorrhage we may exclude the traumatic cases because they are frankly surgical, and at present ignore the intracerebral apoplexies as being seldom surgical. A small number of cases of cortical hemorrhages due to pachymeningitis may be recognized and occasionally dealt with.

Hemorrhage within the gastrointestinal tract is one of the problems with which the physician has to deal.

Hemorrhage from gastric ulcer, suspected hemorrhage from cancer of the bowel, massive hematemesis—when should they be turned over to the surgeon, and how should the hemorrhage be dealt with? As a rule, this condition is not an emergency, but only a sudden revelation of the condition which is its cause. The patient should be kept at rest until the hemorrhage ceases, after which transfusion and other means should be used to restore him to a condition in which surgical diagnosis may be attempted.

Just a word about transfusion. The fact that this very useful procedure has been unfortunately abused is no reason why it should not be properly called into service when necessary, and nowhere will it be more useful than in case of hemorrhage. It is a procedure to be considered very definitely, from the point of view of both the physician and the surgeon. It is most important that the donor's blood should be sound and that it should match that of the recipient. It is, of course, a transplantation of tissue, and if improperly done may do more harm than good.

EMBOLISM AND THROMBOSIS. In regard to embolism and thrombosis, there are two points in which surgery may be very useful. Embolism occasionally occurs in the peripheral arteries; and in the few cases where the surgeon has proper time, which will be only within a few hours, and where the unfortunate embolism is not repeated, very good results are obtained by cutting down on the artery and removing the clot. Unfortunately, however, embolisms are usually multiple.

In the thrombosis which occurs in certain infections involving the extremities, there can be no doubt that ligature of the veins involved on the proximal side of the thrombosis is a most important procedure in preventing pyemia. We are familiar with its use in ligation of the internal jugular in cases of lateral sinus thrombosis, and the same procedure might, I believe, be made use of more often in other infections.

SPREADING INFECTION. Spreading infection is, I think, sometimes considered too much of a surgical emergency, because we have, all of us, a sort of superstitious feeling that the knife is good for infection as such. I have heard a famous surgeon speak of the antiphlogistic touch of the knife. There is no such thing. The mere use of the knife simply adds trauma to the patient's burden. The knife is used to free fluid under pressure, or to remove a spreading process, such as gangrene, which can be stayed in no other way. So, one removes a gangrenous extremity or a gangrenous appendix, and, so, one incises an abscess which is causing pressure necrosis. But to incise a spreading cellulitis, which we see so often done, is simply to fan the flame.

The neglected appendicitis goes on to peritonitis all too rapidly; and when it is too late, the physician is quite prepared both to recognize and to call for surgical

interference in most of these acute conditions. In most, but not in all.

May I draw attention to one condition which has as yet in great part escaped the notice of the practitioner and which I believe would greatly benefit by further study? I allude to the acute or subacute hydrocephalus associated with the infections of the meninges, and I am venturing to discuss this condition briefly because it is a type and a very perfect one, it seems to me, of that group of conditions in which fluid under pressure demands immediate relief. This fact the physician has recognized better than the surgeon in dealing with, or rather, in attempting to deal with this condition. He has attempted to relieve the increased intracranial pressure by repeated lumbar puncture and even by cistern puncture, realizing well enough the extremely short period of relief thus obtained, but having nothing better to offer. The surgeon, on the other hand, in dealing with meningitis has been obsessed with the idea of drainage for infection, a notion which in less than a hundred years will be found to have had as much mysticism in it as the blood-letting of our ancestors. Drainage (subtemporal, suboccipital) above or below the tentorium while the fluid is accumulating in the ventricles increases its pressure unrelieved.

FLUID UNDER PRESSURE.

1. Acute hydrocephalus.
2. Fluid in the chest.
   a. In the pericardium.
   b. In the pleura.
3. Fluid in the abdomen.
4. Urinary pressure.
5. Acute hydrocele.

I cannot discuss the subject of fluid under pressure more fully at this time, and merely draw attention to it in passing. In the presence of fluid under pressure, two things are necessary: recognition and relief.

The presence of intraventricular pressure is to be suspected in any case of meningitis showing signs of increased intracranial tension, headache, vomiting, choked disk,

etc., recognized by the manometer reading of the spinal pressure, which, by the way, cannot be guessed at with any degree of success, and finally determined by the injection of a little air (30 to 50 c.c.) into the spinal canal and a roentgen-ray exposure in two planes. It is not necessary to exhaust the spinal fluid; the injected air will show the degree of dilatation of the ventricle and the presence or absence of brain-stem block. If this is present, a section of the corpus callosum is indicated. This will convert an internal hydrocephalus into an external one. It will immediately relieve the subtentorial pressure. It will furnish access to the arachnoid channels of absorption over the hemispheres, which will be more or less permanent. It is readily and quickly accomplished. The skull is trephined 2 cm. from the midline along the right parietofrontal suture. The dura is nicked and a needle introduced into the ventricle. When the tension has been thus reduced, the dura is opened and a flat silver spatula, 1 cm. in width, is shaped so as to pass over the mesial edge of the hemisphere and along the surface of the falx down to the corpus callosum. It is then thrust through this structure into the dilated ventricle. A gush of fluid follows; the flat probe is gently moved so as to assure a 2 cm. section and withdrawn. The dura is closed. The trephine button is replaced and the scalp carefully closed in layers.

I know of no other operation which attempts to fulfill the indications in these cases.

In acute hydrocephalus, the diagnosis is made by lumbar puncture with manometric reading, and by encephalography.

Inject 25 to 50 c.c. of air into the spinal canal after withdrawing an equal amount of fluid.

Roentgenography also aids in diagnosis.

Acute internal hydrocephalus in meningitis is due to arachnoid block, is a common cause of death, may occur very early in the disease, and is relievable by: lumbar puncture; ventricular tap, which gives

temporary relief for a few hours; and corpus callosum section, which gives permanent relief.

THE PLACE OF SURGICAL DIAGNOSIS

A word as to the place of surgical diagnosis. I said that the distinction between surgery and medicine is sometimes a curious thing, yet very necessary and very real, and nowhere is the distinction between surgery and medicine more illogical than in the distinction between medical and surgical diagnosis, yet nowhere is this more real; for the method by which the physician approaches his problems and the angle at which the surgeon attacks his are not the same. The physician imagines a scientific problem which he approaches in a properly scientific attitude of doubt. His mind is open and his eyes perhaps are shut. He proceeds to reason. He makes his solution as far as possible by exclusion, so that his logic may be secure and that he may feel that his findings on paper are irrefutable. But the surgeon has a different sort of method. He has to meet in daily life the sort of things which do not permit the physician's method of approach. For instance, a patient comes into his office uttering the characteristic sounds of one who has a cleft palate, and the surgeon immediately suspects a cleft palate. He says to the patient, "Open your mouth," and examines and finds a cleft palate. This is a simple instance. The surgeon's mind proceeds from suspicion to an immediate attempt to verify or disprove. He is obliged to fall back on direct methods of examination with instruments capable of inflicting trauma, and not the least of these is the hand. How often the patient says, "Your fingers are like steel," no matter how careful you try to be. The fingers may do harm, but not so much harm as the other instruments which are at the surgeon's disposal and which he finds himself frequently obliged to use. Even a roentgen-ray examination, if one is incautious, may do harm. Not so long ago a woman came to my office, who had

had 126 roentgen-ray exposures of the abdomen in an attempt to verify suspicions and find out her trouble. She had begun to show the effect of these exposures even upon her skin, and while no indications were evident of any internal damage having been done, I have no doubt that she had sustained it.

By surgical diagnosis is here meant direct methods of physical examination with instruments capable of inflicting trauma. Such are:

    All roentgen-ray examinations.

    All endoscopies.

    Aspirations.

    Diagnostic removals of tissue.

    Exploratory sections, to be properly used only when:

(a) No harm is done.

(b) Some good is accomplished.

In cases of suspected intestinal obstruction, the administration of a barium meal has in more than one instance precipitated a condition which might perhaps have been avoided. Such cases, if examined by the roentgen-ray at all, should be dealt with only by enema.

All endoscopies may be considered dangerous in certain acute conditions. Acute colitis does not do so well under a sigmoidoscopy. We have all seen cases of harm resulting from cystoscopy and from unwise pyelography.

The diagnostic removal of tissue is a procedure not without danger. It is so simple to curette and remove a piece of tissue to see if it be cancerous, and yet this investigation may be enough to disseminate the growth and by this very act place it beyond the reach of proper surgical care.

THE TIMELINESS OF SURGERY

We have seen how important is prompt recognition and intervention in the group of conditions of which I have ventured to submit a somewhat typical instance. There is, however, another aspect of this group of conditions, and it may be stated as a principle that while diagnosis should be

made as early as possible, it should be made by measures which do not in themselves do the patient harm, and surgical

SURGICAL TREATMENT OF SYMPTOMS

This may seem to be merely a platitude to some of you; but allow me to discuss
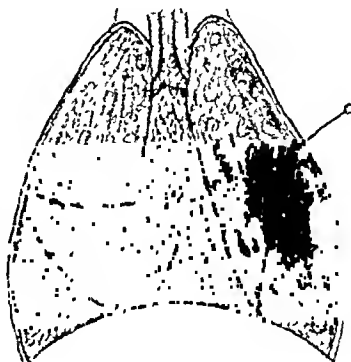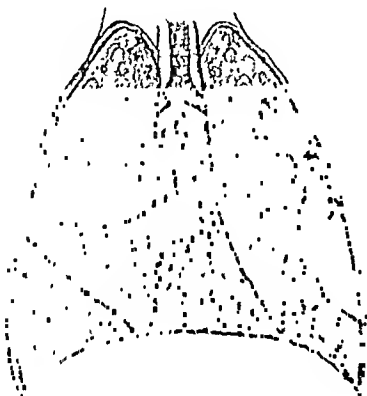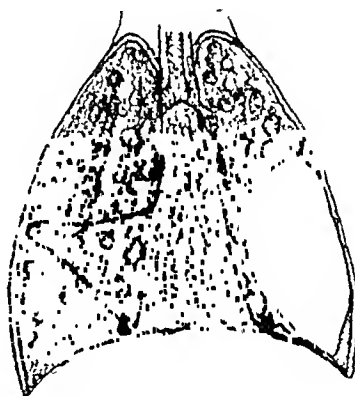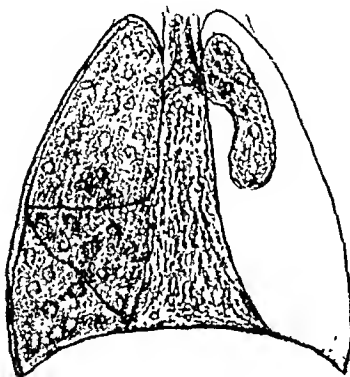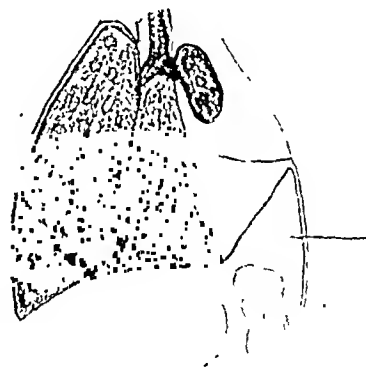
FIG. 1. Punctured wound of the lung by paracentesis needle.
FIG. 2. Small sacculated empyema as result of stab wound of infected lung; another stab higher up.
FIG. 3. Sacculated empyema, small abscess of lung resulting from stab wounds.
FIG. 4. Sacculated empyema increasing in size at the expense of the adherent lung.
FIG. 5. Free pleural empyema.
FIG. 6. Pyopneumothorax showing ascent of the diaphragm on the left side.

intervention should be accomplished at the proper time. To hasten this unwisely is as unfortunate as to delay it foolishly.

rather briefly a common condition and its more or less standardized management, in which I think you will agree with me

that both these principles are regularly violated. I refer to the diagnosis and treatment of empyema, particularly the metapneumonic empyema of childhood. In the course of or following a pneumonia, sometimes after a subsidence of fever and an apparently well-begun recovery and sometimes in the course of an unduly prolonged and unsatisfactorily protracted illness, physical signs in the chest, such as flatness and absent breathing, lead the physician to suspect the presence of pus within the chest. He considers his duty plain and proceeds to aspirate the chest.

Let us suppose that he finds pus at the first tap. The next move is plain. Get a surgeon and have a rib resected and the empyema drained. Too often this is done with no consideration of the stage of the disease or the condition of the patient, no question as to whether the lung be fixed or not, no question as to the condition of the other lung. The disease must be treated. The pus must be evacuated and the little patient must take his chance.

But perhaps the child is more fortunate and at the first aspiration no pus is found—a dry tap. How soon and how often will it be repeated? At short intervals, every few days, until at last the repeated stab wounds of infected lung and pleura bring their reward and an empyema has been proved.

How many cases of empyema would never have occurred if these cases of irregularly resolving pneumonia had not been subjected to needling? It is impossible to say, but I am persuaded that a weekly roentgenographic study of such cases would not only diminish the mortality, but would cut the morbidity in two.

Nor does the use of the hollow needle end here. In one of the army camps I found 20 fatal cases of peritonitis in something over 200 cases of empyema, most of which were treated by repeated aspiration. In a study made with Cole we found that after aspiration the diaphragm on the left side not infrequently reached the level of the fourth rib.

When one remembers that a stab wound through an infected pleura and the left leaf of the diaphragm would reach the lesser sac and when one reflects at the same time how obscure the signs of such a peritonitis often are, one wonders how often this complication exists in civil practice.

There are occasions when a large effusion in the pleura embarrasses the respiration or the heart, and a thoracentesis should be done—once; I doubt the wisdom of its repetition. Certainly the chest should not be drained until the lung has had time to become adherent, until the other lung is clear and until the patient's nutrition and fluid balance are as well cared for as may be.

I have discussed the surgical aspect of this complication of pneumonia because I think it is a rather typical example of some errors into which we easily fall with many somewhat similar conditions:

First, a diagnostic procedure which is not innocent; second, a failure to appreciate the importance of selecting the proper time for surgery; and third, the grave danger of standardizing a surgical treatment for a disease rather than adapting treatment to the patient.

THE SURGICAL COMPLICATIONS

This may be (1) an exacerbation of an underlying handicap or (2) an accidental invasion from without, as in diabetes, infection leading readily to gangrene.

In this connection the relation of surgery to diabetes may be selected as an example.

The diabetic patient has a 20 to 25 per cent chance of dying of a surgical complication of his disease. This liability is greatest in the sixth decade. Fifty-two per cent of all cases occurred in that period in the series of Eliason and Wright. The cases of surgical deaths were: septic and gangrenous legs, 36; carbuncles, 9; acute appendicitis, 4.

The fact that diabetics are notoriously bad surgical risks entitles them to most careful preventive measures. They should be warned against all apparently slight

forms of infection, and these should be promptly attended to when they arise.

The fact that they are so vulnerable to infection should exempt them, if one may so phrase it, from all operations except those of necessity; and when a patient presents himself with diabetes and an

FIG. 7. Encephalography showing arachnoid space outlined in air.

inevitable operative condition, he must be treated as if he were, as Foster has said, a candidate for coma.

The details of the medical treatment may well be left with the physician, who will do everything in his power to forestall acidosis.
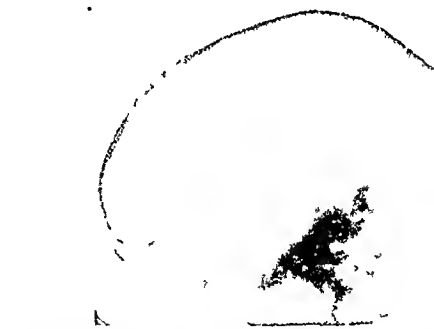
FIG. 8. Encephalography, internal hydrocephalus with obliteration of the arachnoid spaces over convexes.

SURGERY IN CERTAIN TOXIC STATES

In the presence of infection in gangrene, surgery should not be delayed, and spinal anesthesia should be used whenever possible. In situations where this is not possible, nitrous oxid and oxygen in skilled hands is better than ether.

Gangrene occurs in two forms: the dry gangrene of one or more toes, and the

moist, septic gangrene spreading up the foot and leg.

In older patients in whom arteriosclerosis overshadows the diabetes, the dry gangrene may be treated by conservative amputation through the lines of demarcation.

In the moist variety the amputation
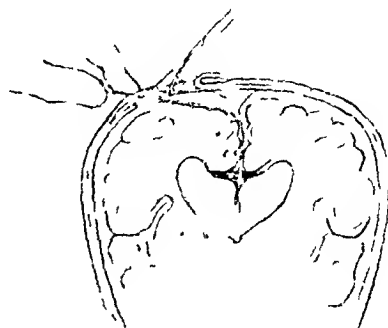
FIG. 9. Corpus callosum section, author's method.

should be immediate, through the lower third of the thigh. Since the development of anti-gangrene sera in the late war, French surgeons have made use of this procedure in diabetic gangrene. We have followed this precedent in using the only American serum available, which has been useful in our hands.

In a small series of cases (6 or 7) we studied the gangrenous tissues removed at operation and found them filled with the Welch bacillus. In several cases high amputations, done with scrupulous precautions, of course, gave a gas infection of the stump. These were controlled promptly by the use of the serum; and its subsequent use in a few cases has been followed by limitation of the spread of a moist gangrene at the base of the toes. I believe it is a useful adjunct, but one which should not be used as a substitute for surgery.

As an additional factor in the after-care of the diabetic, as, in fact, in all elderly patients, exercise in bed is recommended. In order to be useful, this should be regular, vigorous and amusing. Making motions is a bore. I can recommend the use of a string of toy balloons above the patient's bed within reach of his hands and feet. Once an

hour, on the hour, he will rise on his pillow and smite these toys with a will, with an effect on his blood pressure and blood sugar that no calisthenics can equal.

There is another relation which surgery and diabetes may bear to each other. I allude to the connection of pancreatitis and diabetes. Vischer reports 5 cases of glycosuria apparently secondary to abdominal and rectal infections. These improved following surgical operations, which suggests the importance of such a relation. Rabinovitch analyzed the statistics of the Montreal General Hospital and concluded that nine times as many patients had both cholecystitis and diabetes as would be expected if the diseases were completely independent of one another.

THE SURGICAL HANDICAP

This may consist of a chronic medical disease and a surgical condition which aggravates the trouble, such as:

Diabetic patients.... Cholecystitis
Cardiac patients..... Hyperthyroidism
Tubercular patients.. Adhesive pleurisy
Chronic dyspepsia... Gastrointestinal deformity and infection

I have implied more than once in what I have said that the patient does not benefit by a misunderstanding between medicine and surgery. Nowhere is this more clearly seen than in the too unfortunate fate of the chronic dyspeptic.

If any sick man deserves a scrupulous and intensive study it is he. How often does he get it? More than this he needs, however, a wise judgment based on the results of the examination and an intelligent program with or without surgery.

The dyspeptic comes on, is brought to the surgeon, after having had, as a rule, a good deal of treatment and more or less diagnostic study. It is comparatively rare for him to have had a true abdominal survey. In fact, unless he is a poor man and has had the good fortune to go to a good clinic, he will hardly find the mecha-

nism for making one. He is much more likely to wander from one specialist to another until he falls into the hands of haphazard surgery.

It seems as if a more logical procedure might be expected. There is no more grateful patient than the cured gastrointestinal invalid, even if this cure was accomplished after many other operations by dilatation of a stricture of the ureter. Nor is there any sadder sight in surgery than the cancer of the stomach, rapidly growing and invading other organs, which might have been recognized one, two or five years before as a deeply penetrating ulcer.

We do not know the cause of gastric or of duodenal ulceration. It would seem as if so consistent a disease might very likely be due to one exciting cause. Perhaps it is; we do not know. We do know that many ulcers heal and patients recover, some with surgery and some without; that many of these cures are only temporary and that recurrences are not uncommon even after surgery. It would seem, however, that a more or less consistent program could be arranged and the gastrointestinal tract treated as a whole.

There are foci of infection in the mouth, about the pylorus, about the ileocecal junction, and occasionally in the sigmoid and anus. These are all susceptible to surgical treatment and should be considered from above downward. In short, the alimentary tract should be cleaned up just as we do, or attempt to do, with the genital or the urinary.

There is a group of patients, particularly the younger ones, who recover and stay well on medical treatment alone. This group will be increased if infected tonsils, teeth, and sinuses are attended to during or after the medical cure.

A second group showing recurrences after this treatment will show, on exploration, more or less chronic infection of the terminal ileum, cecum, and appendix, as well as of the gall bladder, the duodenum, and the pancreas. It is in such a group of patients that by removal of the chronically

infected gall bladder and as much of the ileo colic angle as is irreparably damaged the constant stream of re-infection will be interrupted. The liver freed from its load of poison, the duodenitis and the pancreatitis will heal. It is in such patients as this that an incipient pancreatic diabetes may sometimes be detected and apparently aborted.

Is it too much to say that a patient suffering from chronic digestive disturbances should have the benefit of both medical and surgical diagnosis?

He should have a full and careful study made of his history; a thorough physical examination; his heart and lungs ad genitourinary tract and nervous system not mentioned in passing, but examined and assessed; a proper laboratory examination of the blood and of the urine; and a genuine roentgenographic study. This is only the method; it must be applied by a man of knowledge and skill, for a diagnosis is, after all, an opinion and requires a mind for its conception. One sees extrauterine conceptions; one cannot conceive an extra-mental diagnosis.

A story is told of Thoreau, who was interested at the time in Indian arrowheads and had his pockets full of them. One of his friends (I think it is Emerson who tells it) walking with him in the woods, said, "Where do you find so many arrowheads, Henry?" and Thoreau stooped, picked one up, and said with a smile, "I find them everywhere."

It is the fault of surgical diagnosis of the abdomen to find too easily. The fault of the medicineman we must leave to his conscience and his wit.

SUMMARY OF THE SURGICAL HANDICAP

The chronic medical case deserves:

1. A general surgical survey, done in such a way and at such times as to do no harm.

2. Such special diagnostic measures as the type of case may need.

3. Decision on the facts found as to whether surgery is or is not needed.

4. If surgery is decided on, it is to be very definitely carried on as an incident in the medical care of the case.

THE PATHOLOGY AND PATHOGENESIS OF
LEGG-CALVÉ-PERTHES' DISEASE*
(OSTEOCHONDRITIS JUVENILIS DEFORMANS COXAE)

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THE disease which is known today as osteochondritis juvenilis deformans coxae was given its name by Perthes in 1910, shortly after Legg as well as Calvé had each independently described the same condition. It was from the work of these three observers that the clinical and roentgenological aspects of this disease became clear, and were soon recognized everywhere. That all three observers assigned various names, and attributed different natures and causes to this disease does not alter the fact that their clinical and roentgenological descriptions tallied perfectly. Everyone now agrees as to what is meant by Legg-Calvé-Perthes' disease, and the diagnosis can be made with perfect assurance wherever roentgen ray equipment is to be found.

Until quite recently, however, a different situation existed as far as the pathology and pathogenesis of this disease are concerned. The pathological picture was far from clear and the theories of its causation were nearly as numerous as the authors who have written on the subject. Long before this disease was split off from a heterogeneous group of hip-joint affections and became recognized as a separate clinical entity, pathologists had examined heads of the femur from operative or autopsy material from a great variety of cases, and published their findings under a host of titles (malum coxae infantilis, arthritis deformans juvenilis, etc.).

No two names were alike, and the confusion resulting therefrom made the classification of diseases of the hip joint on a pathological basis impossible. There is no question but that some of the cases thus described must have been what we would call today Legg-Calvé-Perthes' disease (or let us abbreviate this to Perthes' disease, for the sake of convenience). A good many, of course, were not. After Perthes' description of the pathology of this condition, in 1913, from a small specimen removed at operation in a typical case, a host of papers appeared on the pathology of Perthes' disease, practically all of them in German, and all of them having some similarity with, and some differences from, Perthes' original description. From our knowledge today of what constitutes the pathological picture of this disease, it is obvious that many different conditions have been described under this title. A great many cases however, (those of Pommers, Frangenheim, Borchard, Erdberg, Kreuter, Negroni, Zesas, and others), can neither be wholeheartedly accepted as Perthes' disease nor entirely dismissed as being something totally different. It may be that these cases are primarily some other condition and have later developed changes similar to Perthes' disease, or vice versa. That this is not impossible I shall try to show later.

Until quite recently, therefore, anyone attempting to collect from the literature all instances of pathological examinations of the head of the femur in cases of Perthes' disease, was confronted with a double problem. First he must pick out those cases which were really Perthes' disease, from reports published under some other title, and second, he must eliminate those cases which were not Perthes' disease from

reports published under that title. Without fairly clear pathological criteria this would seem to be impossible. And yet, as I have mentioned before, such criteria did not lie before us.

In the last few years, however, agreement among authorities on two important controversial points has rendered this selection possible. One is, as Perthes has always insisted, that this condition, while destroying the epiphisis, leaves the joint cartilage intact. The other is that Perthes' and Köhler's disease of the fourth metatarsal are identical. From the masterly work of Axhausen the latter disease has been shown to have a definite and characteristic pathological picture, the most outstanding characteristic of which is massive subchondral bone and marrow necrosis. Therefore, with the criteria of normal cartilage and subchondral necrosis, one is equipped partially with the instruments necessary to choose from the wealth of published observations those cases which can be properly called Perthes' disease. The recent papers of Walter, Konjetzny and Rockemer have also helped to establish these criteria as the ones essential for a pathological diagnosis of Perthes' disease.

Before these criteria were established there were no clear histological differences between Perthes' disease and arthritis deformans, and since it was not generally known then that arthritis deformans can occur early in life, many cases of arthritis deformans were considered Perthes' disease. From the careful work of Axhausen the histological characteristics of arthritis deformans have been firmly established and it therefore follows that cases of this disease can be separated from all those claimed to be Perthes' disease. Since this has been the chief stumbling block up to this time in making the selection mentioned above, the selection now becomes much easier. Even so, it is far from satisfactory; and since the personal element can never be entirely excluded, it will probably not be agreed upon by any two observers.

In this paper I have attempted to select all the cases where a pathological examination has been made of the head of the femur, in cases which I consider to be Perthes' disease, using the criteria mentioned above. I intend to abstract briefly the histological picture in each case and compare them all with a case of my own. I shall also attempt to determine from this analysis what information can be obtained, if any, about the etiology and pathogenesis of this elusive condition. The case which I have studied comes from the service of Dr. Royal Whitman and was delivered into my hands through the kindness of Dr. Samuel Kleinberg. The clinical history follows:

CASE I.   A. de G., aged sixteen. May 1, 1926.
Family History.   Negative.
Past History.   Usual childhood diseases, but no serious illnesses.
Present History.   For the past two months the patient had noticed gradual onset of a right-sided limp, with toeing in of the right foot, and slight pain in the right hip. There was no previous history of injury. Patient was able to walk unassisted.
Physical Examination, on May 4, 1926: Negative except for local condition. Local condition: there was a flexion and adduction deformity of the right limb with marked restriction of motion of the right hip joint. There was tenderness on pressure over the head of the femur but no shortening of the leg.
Roentgen Ray.   There is flattening of the head of the femur, with extension of the capital epiphysis backward onto the neck, to very near the trochanter. The inner half of the head is but little changed from the normal. The neck is broadened and somewhat shortened with slight increase in density at about its middle. Roentgen-ray diagnosis: Legg-Perthes' disease.
Operation.   May 4, 1926. Right hip was stretched until the deformity was completely corrected and the limb brought into complete extension and abduction of 30°. A plaster of paris spica from nipple line to the middle of the leg was applied. Roentgenogram after manipulation showed that the pressure of weight bearing had been transferred from the flattened head to the extreme outer border of the head.

After Treatment. The patient was discharged on June 3, 1926, and not seen again until October 28, 1926. At this time the spica was removed and the patient was seen to have 5° to 10° of abduction. He still had some pain on pressure over the head of the femur. A short spica was applied and the patient was discharged.

On his next return Jan. 11, 1927 the right limb was again seen in a flexion-adduction deformity and abduction was entirely checked. The patient, however, was symptom free. Another stretching was advised but patient refused to permit it. A plaster spica was applied and patient advised to return in four to six weeks.

In March, 1927, the patient returned walking with a marked limp but with no pain. The limb was completely extended and slightly adducted. There was moderate muscular atrophy and shortening of one inch. Dr. Whitman's note at this time clearly describes the situation: "He returns after having worn a nondescript spica. The limb is now completely extended and slightly adducted. There is moderate atrophy. The original intent in this case was, as the head of the femur was flattening under pressure, to put it in extreme abduction, that the point of pressure might be removed to the outer part of the head. In the original picture taken here, this seems to be accomplished, but in the interval the plaster has not fullfilled its functions. The progress of the disease is very marked. A picture taken in the autumn shows a very marked flattening of the epiphysis and a picture taken at the present time shows that the process has advanced very much. The epiphysis, of the cap type described by Legg, has been extended outward so that it now practically reaches the trochanter, and the weight bearing is done only on a small section of the head, which is completely flat. As a result, the range of abduction is completely checked. The limb is now practically completely extended and there is a range of flexion of about 70°.

Patient now walks with a marked limp (limp evidence of adduction). He states he has no pain. As this process has gone on so rapidly, a reconstruction operation will be done as he has probably reached his full growth, about five feet, ten inches, and there is also considerable shortening from the flattenting of the head.

Second Operation. March 28, 1927, Dr. Whitman: The joint was opened in the usual manner and the head of the bone extruded. It was found to be flattened and irregular in outline and was entirely removed. The acetabulum was found to be fairly covered with cartilage except just beneath the outer rim and about the ligamentum teres there seemed to be formation of new tissue. The trochanter was replaced in the usual manner and the limb placed in a long spica in extension and 20° of abduction.

The patient was seen three months after operation June 11, 1927. At this time he was able to walk around with the aid of a cane without any pain. The limb is completely extended and abducted to 20°. There is a range of flexion of 15°. Roentgenogram shows that the reconstruction operation has been entirely satisfactory.

EXAMINATION OF SPECIMEN

Macroscopic Appearance (Fig. 1). The surface of the head of the femur was markedly flattened and thrown into three main folds, with deep crypts in between. The surface cartilage was clear, white and glistening, and followed the irregularities of contour without apparent loss of substance. From the pinkish tissue beneath, one could see that the cartilage varied in thickness and in one area was so thin that the granular spongiosa could be distinctly seen (A). In the depths of one of the crypts a dark red area 1 cm. in diameter was visible through the cartilage, having the appearance of a subchondral hemorrhage (B). An area about 3 cm. in diameter was denuded completely of its cartilage from operative trauma (C). In only one small area at the edge of the specimen laterally was a fairly regular spherical contour observed (D). On the outermost circumference of the head, the cartilage was somewhat lifted up from the underlying bone and hung in several shreds, with pieces of the capsular ligament attached to it (E).

Technique. The entire specimen was fixed in 10 per cent formalin for one week. It was then cut into three main pieces, one of the lines of section passing through the thin area of cartilage, and the outer through the furrowed area. The blocks thus obtained were fixed for four days more

in 10 per cent formalin, decalcified in 5 per cent nitric acid and then embedded in paraffin and cut as thin as possible. Ordinary hematoxylin and eosin stains were made, as well as Weigert's elastica stain for blood vessel structure.

FIG. 1. Drawing of gross specimens viewed from above (slightly reduced). A, thinned out area of cartilage; B, deep crypt with subchondral hemorrhage; C, area of loss of cartilage from operative trauma; D, lateral portion of head with fairly spherical contour; E, shreds of capsule attached to cartilage.

Appearance of Fresh Cut Section (Fig. 2 and 3). The cartilage varied in thickness from 1/2 mm. to 5 mm. and at the point of greatest thinness (Fig. 1, A) was torn by the passage of the saw (Fig. 2, A). At the junction of the bone and cartilage,

municated with the surface through the above mentioned tear in the cartilage. Only on the very rim of the specimen did the reddish mass merge into a fine pink line, representing the normal spongiosa. (Fig. 2, c). Embedded in the reddish material were several small islands of whitish tissue having the consistency of cartilage (Fig. 3, A). These were loose and could readily have been picked out. A distinct epiphyseal line was nowhere to be seen. However, on tracing the surface cartilage laterally it was found to be continuous with one of the islands just mentioned, which suggested that the island represented the remains of the epiphyseal line. The bony tissue further down appeared grossly normal, its trabeculae being of apparently normal thickness.

Microscopic Appearance (Figs. 4 to 10). Under low magnification (Figs. 4 and 5) the description of the fresh cut surface is readily verified. The reddish material is seen to be composed of completely disorganized bone and marrow, and is surmounted by normal cartilage of varying thickness. At the thinnest area, where the section is torn, the thinning out is seen to

FIG. 2. Fresh cut section (natural size). A, Tear of surface cartilage from passage of saw; B, cleft beneath cartilage containing necrotic bone; C, normal cartilage and bone.

FIG. 3. Fresh cut section (natural size). A, Cartilage island. Note varying thickness of cartilage.

the lesion was readily seen. Throughout the entire breadth of the surface of the specimen the cartilage was separated from the apparently normal bone by a broad band of reddish tissue of putty-like consistency. This band varied in depth and its deepest part was no more than 1 cm. from the surface cartilage. In one area it occupied a cleft between bone and cartilage 5 mm. deep and 2 mm. long (Fig. 2, B) and com-

be due to encroachment of the disorganizing process from below (Fig. 4, A). Figure 5, A shows well the cartilage island suggesting the remains of the epiphyseal line. As can be readily seen from these two figures, the process is not the same in all areas. Indeed, it is a most complicated picture and for the sake of clarity only a few representative areas will be described (indicated by squares on Figs. 4 and 5).

The cartilage is normal, and passes over

into completely necrotic spongiosa. The change from well-stained cartilage nuclei to bone tissue showing no nuclear stain, is a very striking one. In the deeper levels one encounters necrotic and fragmented bone

has been described by other observers). The granulation tissue forms a more or less definite wall around the necrotic areas and becomes continuous with a zone of dense fibrosis of the marrow at their junction
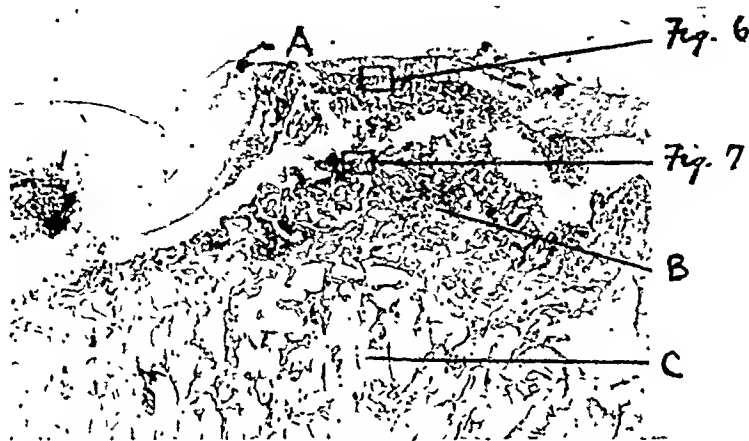
Fig. 4. (See figure 2) Microscopic section (× 3). A, Tear of surface cartilage from passage of saw; B, dense fibrosis of marrow beyond area of necrosis; C, poorly cellular fatty marrow. The squares indicate the areas for figures 6 and 7.

lamellae, lying in a matrix of degenerated marrow and blood (Fig. 6).

Still deeper (Fig. 7) one sees the fragments of the necrotic bone, surrounded by a loose granulation tissue containing

with the normal bone lamellae below (Fig. 4, B). This fibrosed marrow gradually passes over into a poorly cellular fatty marrow (Fig. 4, C).

In other areas the necrotic process is less
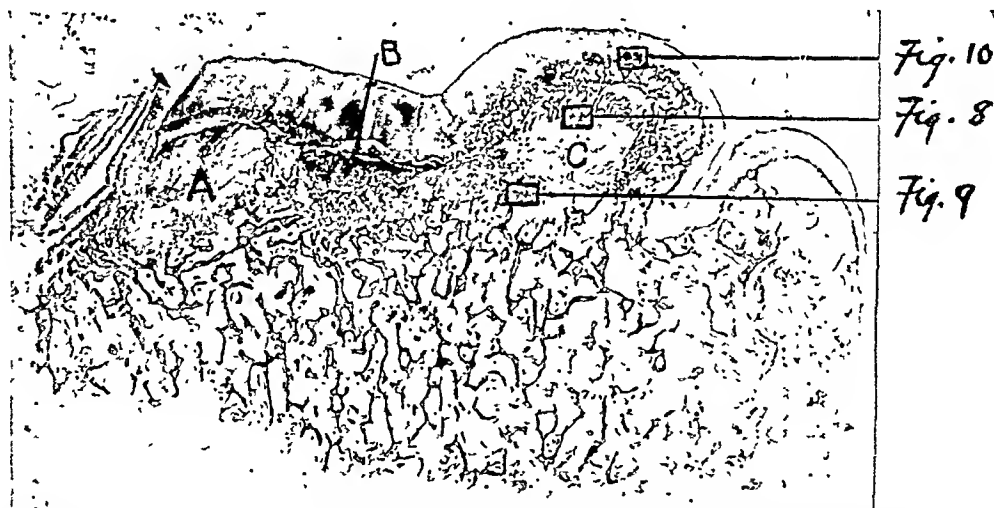
Fig. 5. (See figure 3) Microscopic section (× 3). A, Cartilage island; B, fresh necrosis; C, fibrous tissue. The squares indicate the areas for figures 8, 9, and 10.

many blood vessels and multinucleated giant cells (osteoclasts). This tissue is all densely infiltrated with red blood cells, but contains no polymorphonuclear leucocytes, plasma cells nor eosinophiles (as

pronounced. Here one sees replacement by a more or less dense fibrous tissue, rich in capillaries but poor in cellular elements. In many areas the fibrous tissue assumes an embryonal appearance and appears to

give rise to new-formed cartilage. This has been described as metaplasia, but probably represents the development into osseous
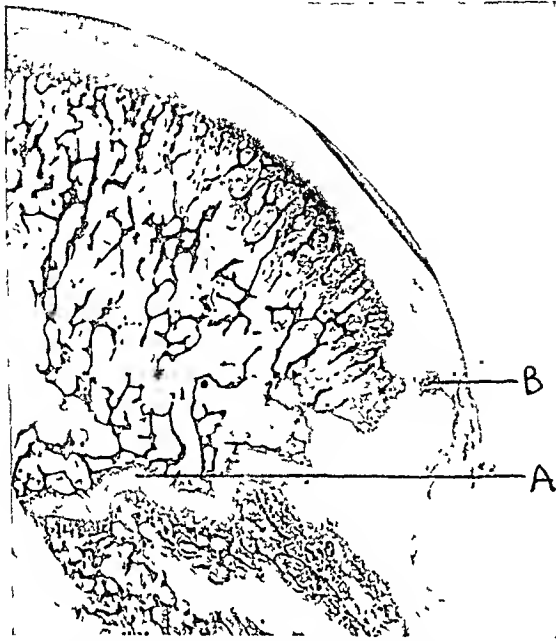
FIG. 5A. Normal head of femur in a young girl (× 3) for comparison. A, Normal epiphyseal line; B, vessels at junction of surface with epiphyseal cartilage.

tissue of a multipotential menenchyme. The cartilage island referred to above consisted of newly formed cartilage and prob-

Besides the cartilage formation directly from connective tissue, there is abundant osteoid tissue laid down on the basis of preexisting bone lamellae. This osteoid tissue is absent where the necrosis is most marked, and is present only where the necrotic tissue has been absorbed and replaced by fibrous tissue. By far the greatest amount of new formed bone is of this "appositional" variety (Figs. 8 and 9). Throughout the involved area the picture of lacunar absorption is frequently seen, and it is not uncommon to see absorption of bone by osteoclasts on one side of a bone lamella and osteoblastic activity on the other. The blood vessels in all sections were carefully studied to detect, if possible, any obliterative thickening such as that described by Konjetzny, but none was found.

In the above description, very fine histological details have been eliminated for the sake of clarity and because their recital would obscure the outstanding changes which I wish to emphasize. There is one finding, however, the exact significance of which is not clear, but which probably has some bearing on the early changes that take place in this disease. It

FIG. 6. (See figure 4) Junction of bone and cartilage (× 150). A, Normal cartilage (note well stained nuclei); B, necrotic bone (see loss of nuclear stain); C, necrotic marrow and blood.
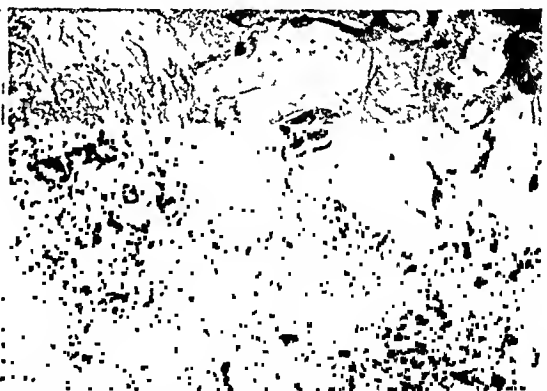
FIG. 7. (See figure 4) Area of necrosis (× 150). A, Fragments of necrotic bone; B, granulation tissue infiltrated with blood containing many giant cells.

ably is an example of this "metaplasia." Although it occupied the site of the old epiphyseal line, its histological appearance makes it seem very unlikely that it is the remains of that structure.

consists of widely dilated blood vessels between the spongiosa and the cartilage, bordered above by normal cartilage, and below by irregularly calcified bone (Fig. 10). Such a picture occurs only in an area where the spongiosa contains well pre-

served bone cells and has maintained its structure.

To summarize the pathological findings briefly, we have:

FIG. 8. (See figure 5) Area of repair (× 150). A, Embryonal type of fibrous tissue; B, osteoid tissue; C, osteoblasts.

1. Extensive subchondral necrosis of bone and marrow.

2. Complete destruction of the epiphyseal line.

3. Fragments of dead bone, surrounded by richly vascular granulation tissue containing many multinucleated giant cells.

4. Fibrous tissue replacement of necrotic areas.

5. Osteoid tissue formation from fibrous tissue and from preexisting bone lamellae.

6. Dilated blood vessels in the undersurface of the cartilage.

Despite the tremendous literature on Perthes' disease, there have been only eleven cases examined histologically, and three of these represent merely fragments of tissue removed at operation. The eleven cases were reported by eight authors, and in order to compare their findings with mine I shall abstract briefly the pathological picture of each. For the sake of brevity I have omitted all reference to clinical and roentgenological data, though it is to be understood that in every instance the findings were typical of Perthes' disease. Here also, tedious descriptions of finer cellular changes have been eliminated as unnecessary for our discussion. The cases follow in chronological order.

Perthes (1913).

Schwartz (1914), 1 case. After two years of symptoms a boy of seven years was subjected to operation because of the suspicion

FIG. 9. (See figure 5) Area of repair (× 150). A, Loose fibrous tissue; B, new formed bone; C, osteoblasts.

of tuberculosis. At operation it was seen that the surface of the head of the femur was flattened and indented, and extended over the neck in a broad roll. A wedge-shaped segment was removed, which

FIG. 10. (See figure 5) Junction of bone and cartilage where there is no subchondral necrosis (× 150). A, Normal cartilage; B, dilated blood vessels between cartilage and bone; C, normal spongy bone.

showed the following: the joint cartilage was normal. Beneath it were seen many islands of bone and cartilage surrounded by fibrous tissue and fatty marrow. There was no mention made of further histological findings and if it were not for incontrovertible roentgenological evidence one

might not be sure that the case was one of Perthes' disease.

Phemister (1920), 1 case. This was a boy of ten who was operated on eight months after the onset of symptoms. It was noted that the surface of the head of the femur was markedly distorted and flattened, but that the cartilage was unimpaired. A small window was cut out for histological study. In removing the specimen, a cavity containing necrotic debris and several small sequestra was opened into. The specimen showed intact cartilage, subchondral necrosis of bone and marrow and a richly cellular granulation tissue containing giant cells surrounding dead bone fragments. Cultures of the necrotic material in the cavity were sterile.

Axhausen (1923), 1 case. At autopsy the head of the femur of a nine year old child showed the following: the spherical shape of the head was preserved and the only surface irregularity seen was a small depression at its highest point. The cartilage was intact. On section the diaphysis and epiphyseal line were normal. The subchondral bone and marrow were necrotic and were surrounded by an outgrowth of young connective tissue, apparently springing from the angle between the surface and the epiphyseal cartilage. Some early new bone formation was seen being laid down on the old spongiosa lamellae. No leucocytic exudate was encountered.

Heitzman (1923), 2 cases. The first case was that of a nine year old boy in whom a resection of the head of the femur was carried out. The surface of the head was practically flat, having a slight convexity only at its outer part. The epiphyseal cartilage lay only 6 mm. from the surface. Between the two cartilaginous surfaces was a broad area of necrotic bone and marrow, enclosed in granulation tissue. Many osteoclasts were seen absorbing the necrotic rests. There appeared to be a bridge of cartilage extending from the epiphyseal line to the surface. Underneath the necrotic area there was a broad gap in the epiphyseal cartilage 1 cm. wide, through which

projected a plug of granulation tissue extending downward into the diaphysis.

The second case was that of a 13 year old girl in whom a resection was also performed. Here also the head was remarkably flattened, with wrinkling and furrowing of the otherwise normal cartilaginous surface. On section the epiphyseal line had almost entirely disappeared with only a few fragments of cartilage remaining. Laterally under one of the furrows was a small cyst 1 cm. in diameter, appearing to extend into the diaphysis. Microscopically the joint cartilage was well preserved. In a cleft under the joint cartilage lay rests of necrotic bone and marrow. Fibrous tissue rich in cells and blood vessels penetrated into this area from the diaphysis and contained a fine network of new built bone.

Riedel (1923), 2 cases. The first case was that of a ten year old patient in whom operation was performed ten months after the onset of symptoms, the head of the femur being resected. The surface of the head was pressed flat and strongly indented. In the region of attachment of the ligamentum teres there was a grave-shaped depression. On section, a peasized free sequestrum was seen beneath the depression noted above. All around this was extensive necrosis of bone and marrow. The boundary between bone and cartilage was lost and the area filled with blood. The surface cartilage was slightly thickened and showed in its under surface small hemorrhages and islands of bone. The epiphyseal line was nearly completely destroyed, a few cartilage rests remaining. In the spongiosa a few small blood filled cysts were seen. In and around the necrotic bone fragments lay a richly cellular granulation tissue containing many giant cells, in some areas having the appearance of the giant cell tumor of bone. Further away the bone marrow was markedly fibrotic and contained an inflammatory infiltration with plasma cells, round cells, leucocytes, and eosinophiles. In some areas cellular osteoid tissue was seen. Osteoblastic activity and lacunar absorption

were going on together, often on the same bony lamella.

The second case, a boy of nine years, was operated on about ten months after the onset of symptoms. The surface cartilage of the head of the femur showed a crescent shaped depression beneath which the bone felt very soft. While a small fragment was being removed it was noted that the subchondral region was softened, of reddish color, and contained several gray-green areas (cartilage islands?). Microscopically, the fragment removed showed edematous connective tissue containing scattered hemorrhages and an inflammatory infiltration around the vessels.

Walter (1925), 1 case. A boy of seventeen years with a history of polyarticular rheumatism two and a half years before admission, of many months duration, came to the hospital because of persistence of symptoms in the right hip joint. At operation the head of the femur was resected. The head was flattened and mushroom shaped. Its cartilaginous surface was markedly distorted and denuded, in great measure, of its cartilage. Through the denuded areas extruded a reddish tissue. The ligamentum teres was lacking. The acetabulum showed the same denudation of cartilage as the surface of the head of the femur. On section the surface cartilage was of varying thickness and markedly irregular. At the junction of cartilage and bone were several cherry red areas, triangular in shape, with their bases toward the joint surface. These areas extended down half the way to the epiphyseal line, which was intact. Microscopically the cartilage was seen to be nearly completely destroyed and replaced by granulation tissue which had given the reddish appearance to the surface. The cherry red areas were seen to be composed of necrotic bone and marrow surrounded by blood and granulation tissue. Many giant cells were seen absorbing the necrotic bone fragments, and eosinophiles, plasma cells, and leucocytes were scattered throughout the granulation tissue. Into the granulation

tissue osteoid tissue was growing from remains of the spongiosa and from bony trabeculae, which were simultaneously undergoing lacunar absorption.

Konjetzny (1926), 2 cases. The first case was a boy of seventeen who was subjected to operation five and a half months after the onset of symptoms. The head of the femur was resected and showed the following picture: Its surface was somewhat sloping and irregular, but was still distinctly spherical. The cartilage was intact throughout. "An antero-posterior section showed an extensive infarct-like subchondral necrosis of a depth of 1½ cm., extending as a flat area for 3 to 4 cm." Microscopically there was complete bone and marrow necrosis in the above mentioned area with hemorrhagic infiltration. On the border of the necrotic area was a well demarcated zone of cell-rich granulation tissue containing many multinucleated giant cells quite resembling the tissue of the giant cell tumor. In the surrounding living bone there was fibrous invasion of the marrow. The capsular vessels showed striking obliterative thickening.

The second case was a child who died of pulmonary tuberculosis eight years after the onset of Perthes' disease. At autopsy the affected head of the femur was found to be markedly deformed; with the neck and the great trochanter it formed one large cylindrical mass. The surface cartilage was for the greater part normal, but in the region of the ligamentum teres it was irregular, somewhat thickened, and scarlike. On section, the epiphysis was markedly diminished in size and the epiphyseal line was nearly completely destroyed. The subchondral bone trabeculae were markedly thickened and in a large area were broken up into many small necrotic fragments. In the region of the ligamentum teres the surface cartilage was from two to four times the normal thickness and overlay small cystic areas containing small islands of cartilage. The necrotic fragments were composed of dead bone, as shown by their trabecular struc-

ture. The surrounding bone showed abnormally thick trabeculae, with marrow spaces filled with cell-poor but highly vascular fibrous tissue. Further away the bone and marrow were normal. The diameter of the acetabulum in this area was one-third larger than normal. Konjetzny considered this case to be in an advanced stage in healing, but called attention to the fact that even after eight years there were present necrotic bone fragments and cartilage islands. The healing was therefore far from complete although the patient had long been symptom free and the roentgenogram had shown what appeared to be complete ossification.

Rockemer (1927), 1 case. A thirteen year old boy was operated upon ten weeks after a fall on the right side, because of persistance of severe pain in the right hip. The head of the femur was resected and showed a normal spherical shape with intact cartilage. On section the cartilage was of uniform thickness, but separated from the underlying bone for about two-thirds of its extent. In the cleft thus formed lay soft reddish tissue and in one area a small sequestrum. The epiphyseal line appeared to be intact. Microscopically, the surface cartilage was normal. The subchondral bone was completely necrotic and surrounded by blood and granulation tissue. The sequestrum was buried in a cell-rich and highly vascular granulation tissue containing many giant cells. The bone lamellae somewhat further away were undergoing lacunar absorption and were separated by fibrosed marrow tissue. Some osteoblastic activity was seen in the angle formed by the surface and epiphyseal cartilages where some normal bone was encountered.

DISCUSSION

It can readily be seen from a perusal of these protocols and the chart constructed therefrom that whatever differences there are between one case and another, are but slight. They all show deformity of the surface contour of the head of the femur, varying from a slight depression to marked flattening and furrowing. In all cases but one the surface cartilage was intact, and in that one (Walter) the previous inflammatory hip disease may account for the cartilage destruction. The condition of the epiphyseal line varied considerably. In the cases of relatively short duration it was well preserved. In those of longer duration it was interrupted or nearly completely destroyed. The fact that it was intact in three very definite cases of Perthes' disease would seem to point to the fact that this is not a primary disease of the epiphyseal line. It is quite striking that islands of cartilage were found in those cases in which the epiphyseal line was reported as interrupted or destroyed. This suggests that in some cases the cartilage islands represent remains of the epiphyseal line, while in others they are formed, as most authors believe, as part of the disease process. The most outstanding finding in all of the cases was the extensive subchondral necrosis of bone and marrow and the presence of a richly vascular granulation tissue. That the granulation tissue contained many multinucleated giant cells in the large majority of instances is not to be wondered at, as they are to be expected where dead bone is present. Of more interest is the report of· the presence of leucocytes, plasma cells, and eosinophiles. It is on the basis of the finding of these elements that the inflammatory theory of Perthes' disease stands or falls. Out of the twelve cases such cells were reported as present in five instances, scattered throughout the granulation tissue. In three other cases the authors made a special point of noting that such cells were nowhere to be seen and in the remaining four, no mention was made of such a finding. In no instance were they found forming an infiltrated zone completely surrounding the necrotic area and no picture was described even remotely resembling an abscess cavity. It is also worth noting that bone marrow normally contains all the above mentioned cells in

			Gross							Microscopic									
Author and date	Age	Duration of disease	Shape of head of femur	Condition of surface cartilage	Ligamentum teres	Condition epiphyseal line	Cartilage islands	Structure of surface cartilage	Subchondral necrosis	RBC	Granulation tissue	Giant cells	Leucocytes plasma cells eosinophiles	Healing	Cyst-like spaces	Sequestra	Fibrosis of marrow	Lacunar absorption	Changes in blood vessels
Perthes-Schwartz 1913–1914	7	2 yrs.	Flattened and furrowed	Intact			Present	Normal			+						+		
Phemister 1920	10	8 mos.	Flattened and furrowed	Intact		Interrupted	Present	Normal	Extensive	+	+	+	+			+			
Axhausen 1923	9		Spherical with slight depression	Intact		Intact		Normal	Extensive		+		Absent	Small amount of osteoid tissue				+	
Heitzman 1923	9		Flattened and furrowed	Intact		Interrupted	Present	Normal	Extensive		+	+							
Heitzman 1923	13		Flattened and furrowed	Intact		Destroyed	Present	Normal	Extensive	+	+		+	Small amount of osteoid tissue	+				
Riedel 1923	10	10 mos.	Flattened and furrowed	Intact		Destroyed	Present	Normal with small islands of bone	Extensive	+	+	+	+	Small amount of osteoid tissue	+	+	+	+	
Riedel 1913	9	10 mos.	Spherical with small depression	Intact			Present	Normal	Moderate		+		+			o	+		
Walter 1925	17	2½ yrs.	Slightly flattened and furrowed	Badly damaged	Absent	Intact	Absent	Necrotic and partially exfoliated	Many small pyramidal shaped areas	+	+	+	Few scattered	Extensive osteoid tissue formation	o	o	+	+	
Konjetzny 1926	17	5½ mos.	Spherical but irregular	Intact				Normal	Extensive		+	+					+		Marked obliterative thickening
Konjetzny 1926		8 yrs.	Markedly deformed	Intact		Destroyed	Present	Normal	Moderate	+	+	+	Absent	Solid bone formation					
Rockerner 1927	3	10 wks.	Normally spherical	Intact		Intact	Absent	Normal	Moderate	+	+	+	Absent	Very slight osteoplastic activity	o	+	+	+	
Zemansky 1927	16	1 yr.	Flattened and furrowed	Intact	Absent	Destroyed	Present	Normal with few small hemorrhages in under surface	Extensive	+	+	+	Absent	Slight osteoid tissue formation	o	o	+	+	None observed

fairly large quantities and their presence, therefore, need not necessarily be looked upon as pathological at all. The finding of sequestra in three cases is somewhat puzzling. By a sequestrum I understand a relatively large fragment of dead bone, not a few bony lamellae, and since all the bone of the epiphysis is of the spongy variety it is hard to imagine where a large fragment could come from. Many authors report varying degrees of ossification of the epiphyseal line, and it might very well be that the fragments described as sequestra are really epiphyseal rests, well ossified. Fibrosis of the bone marrow and the phenomena of lacunar absorption were present in about half the cases, but they represent findings more or less to be expected in any process where there is extensive bone destruction. In six cases of moderate duration osteoid tissue was noted growing out into the granulation tissue and in the case of eight years' duration solid bone was observed. This finding is of great importance, as it represents the extent of spontaneous healing. The fact that in the cases lasting two years or more only relatively little replacement by osteoid tissue was seen (in comparison with the large area of necrosis) shows how little can be expected from this method of healing. Of great significance also is the finding, in an isolated case by Konjetzny, of definite obliterative changes in the blood vessels. No other authors appear to have observed this and in my case even after the most careful search I was unable to detect any abnormality either in the vessels between bone trabeculae or in the cluster of vessels normally present in the angle formed by the surface and epiphyseal cartilage. The vessels which are known to run in the ligamentum teres could not be examined, as neither that structure nor any of its remains could be identified. It is of interest that in one other case it was recorded that the ligamentum teres was lacking. That this may have some bearing on the pathogenesis of the disease will be pointed out later.

What, then, gives rise to all these changes? If one were to quote the opinions of all who have written on this subject, it would only lead to confusion because most authors have drawn their conclusions from purely clinical and roentgenological studies. I will mention only a few of the authors, leaving the pathological evidence to speak for itself. Those who desire the whole literature at a glance will find it abstracted in Riedel's paper.

Eight main processes have been considered responsible for Perthes' disease by different observers. They are:

1. Tuberculosis or syphilis
2. Rickets
3. Constitutional factors
4. Arthritis deformans
5. Infection
6. Trauma
7. Embolic vascular occlusion
8. Traumatic vascular occlusion

1. *Tuberculosis or Syphilis.* The pathological evidence so far reported makes it seem hardly possible that either of these two diseases may be responsible for Perthes' disease.

2. *Rickets.* The disturbance of the epiphyseal line in Perthes' disease is of a type never observed even in far advanced rickets. Besides, as previously noted, Perthes' disease may occur without any disturbance of the epiphyseal line. This theory may therefore be quickly dismissed.

3. *Constitutional Factors.* Under this heading come the theories of endocrine dyscrasia, developmental anomalies, and constitutional predisposition. Such theories have arisen from the fact that endocrine types, skeletal abnormalities elsewhere, and slight similiar roentgenogram changes in the mother have been observed in a very small series of cases (Büttner). Of course, one cannot say that such factors could not produce the pathological picture of Perthes' disease, but it is difficult to see how they can. The chief obstacle to the acceptance of these theories is the fact that never have Perthes' and Kohler's disease developed in the same individual,

nor does the disease ever assume a generalized form. Such causes as those mentioned above should act equally on all of the bones in the body, and not pick out specifically the head of the femur or the fourth metatarsal.

4. *Arthritis Deformans.* The pathology of this disease has only recently been adequately described and it has now been clearly shown by Axhausen and others that the marked destruction of cartilage and early massive bone formation with so called mosaic structure, sharply separate arthritis deformans from Perthes' disease. The factors which operate to produce arthritis deformans are not at all well defined; but, granted their presence, there is no reason why arthritis deformans should not develop secondarily on the basis of Perthes' disease. Riedel, who found degenerative changes, vascularization and small islands of bone in the surface cartilage in one of his cases, interprets them as beginning secondary arthritis deformans. This is certainly a significant observation, although the interpretation is open to question. As the patient grows older, the altered mechanics of the joint would seem particularly to favor the development of arthritis deformans, whether the original process were healed or not.

5. *Infection.* An acute inflammatory process of bone presents a clear and characteristic pathological picture. More chronic infections with organisms which have become avirulent are more difficult to recognize. Perthes' disease has been held to be an example of the latter. If it is a form of chronic osteomyelitis, it would have to be one of a very special nature, since there is no pus, no dense infiltrative wall and no involucrum formation. The absence of pus, particularly in the presence of extensive fresh necrosis of bone is hard to understand if the necrosis be due to an infectious agent. Although leucocytes, plasma cells, and eosinophiles scattered throughout the granulation tissue have been found in a few cases, these can be accounted for equally well by the destructive process without calling upon bacterial invasion to explain their presence. The fibrosis of the surrounding marrow present in all of the cases is in itself not specific of any type of disease. Positive or negative cultures of the necrotic material obviously do not aid us one way or the other, since negative cultures may mean that the organisms have died, and positive cultures may be looked upon as contaminations. Therefore, although the theory of the inflammatory nature of Perthes' disease cannot be entirely dismissed, one if forced to withold judgement until more evidence is brought forth to uphold it.

6. *Trauma.* Trauma can be looked upon in two ways. One as the immediate cause of some process such as a fracture, and the other as the predisposing factor for a secondary process such as infection or vascular exclusion. Those who hold trauma accountable for Perthes' disease have considered it in the first sense, and hence, according to this theory, Perthes' disease must be looked upon as a fracture or crushing injury of the head of the femur. The fragmented dead bone surrounded by blood, and the deformation of the surface of the head could well be accounted for by a crushing injury. In that case, however, it should follow immediately on the heels of the particular trauma and not develop slowly over several months' time. The absence of extensive callus formation and the negligible bony union even after two years do not fit in well with what is known about fractures in children. Trauma in this sense therefore does not answer the question satisfactorily. Considered in the light of a predisposing factor to some other process, however, trauma would account equally well for a secondary inflammatory process or vascular occlusion. The lack of convincing pathological evidence in favor of the former, as already pointed out, inclines one to the latter. This view is strengthened by significant experimental and clinical data soon to be cited.

7. *Embolic Vascular Occlusion.* Prac-

tically all agree that the whole pathological picture of Perthe's disease closely resembles an infarct. The localized necrosis, with or without hemorrhagic infiltration, and the fibrous tissue replacement are typical. The differences of opinion arise in the question of how the blood supply to the region is cut off. Schwartz described quite fully the blood supply of the head of the femur, and pointed out that three vessels would have to be plugged, if Axhausen's theory of the embolic origin of Perthes' disease were to be accepted. Two of the vessels are from the periosteum and enter the epiphysis through the angle formed by the surface and epiphyseal cartilages; the third enters through the ligamentum teres. (See section of normal head of femur, Fig. 5A.) It is asking too much of emboli to expect them to arise spontaneously from no apparent source, and to pick out these three small vessels to the exclusion of all other vessels in the body. Reduced to these terms this theory appears very weak, but the fact remains that a *disturbance of nutrition through some sort of occlusion of the vascular supply other than embolic would best account for the pathological picture seen in Perthes' disease.*

8. *Traumatic Vascular Occlusion.* In this last theory we have a combination and a modification of the two previous theories. Curiously enough, it was one of the first to be announced. In 1914 Schwartz, a pupil of Perthes, from exhaustive clinical and roentgenological studies, gave it as his opinion that some trauma to the vascular supply of the epiphysis of the head of the femur was responsible for Perthes' disease. He went even further, suggesting that injury to the vessel in the ligamentum teres came first, followed by injury to the two other vessels from altered joint mechanics. No one seems to have paid much attention to Schwartz's statements, probably because Perthes himself did not believe in them. Quite recently Rockemer has come to the same conclusions and I also feel that they represent the closest approach thus far obtained in the solution of the problem. Not quite analogous, but significant nevertheless, are the experimental results of Müller, who claims to have obtained the pathological picture of Perthes' disease in a few instances after producing epiphyseal separation or dislocation of the head of the femur in a large series of guinea pigs, rats, rabbits, and dogs. He performed his work on animals of all ages, but only those with a cartilaginous epiphyseal line developed bone necrosis. Although somewhat crude, this work gives us not only conformity of experimental findings with our own pathological data, but also offers for the first time, a satisfactory explanation of the age distribution of the disease. It is easy to imagine that in early youth before Perthe's disease has developed, the nutrition through the periosteal vessels and the ligamentum teres is exactly enough to ward off the occurrence of necrosis. It is now quite agreed that no vessels penetrate the epiphyseal line from below and the epiphysis must rely on the aforementioned vessels for all of its blood supply. In adults with completely ossified femora the nutrition of the head is still possible through the neck, even after the destruction of all head vessels. This would seem to account for the absence of the disease commencing in adult life. Although a history of trauma cannot always be obtained, one must consider that, in the disposed age, a relatively slight injury may suffice to call forth the vascular lesion which will upset the nutritional balance of the head of the femur. It may be only a forced rotation or abduction or some sudden normal movement. Some anomaly in vascular arrangement may predispose toward injury of these vessels but whether normally placed or anomalous vessels are injured one need not postulate a complete arterial ischemia. Merely a quantitative diminution in the blood supply should be sufficient.

The presence of large amounts of blood in seven of the above reported cases strongly suggests hemorrhagic infarction,

which may come about from simple venous occlusion. The alterations in the vessel walls found by Konjetzny, the thinning out of the ligamentum teres in two cases as observed by Riedel, and Walter's and my own observation, that no trace of the ligamentum teres could be found, are all very suggestive in the light of the above conception. In Walter's case, particularly, the necrosis appeared to be confined to that region supplied solely by the vessel from the ligamentum teres. The surface contour of the head of the femur in his case was fairly well preserved, and the involvement of the remaining vessels from "altered joint mechanics," as Schwarz suggested, may not have occurred as yet. The clinical observation of Brandes, Putti, and Sudeck, that the roentgenological picture of Perthes' disease appeared to follow reposition of a congenitally dislocated hip is also significant in this regard.

If we should then try to reconstruct the story of Perthes' disease according to this theory, it would appear somewhat as follows: During childhood the blood supply of the epiphysis of the head of the femur by way of the periosteum and ligamentum teres is just adequate to maintain its nutrition, and in certain children, perhaps, differs in its anatomic arrangement. Following trauma, even though unnoticed, one or all of these blood vessels may be sufficiently damaged to interfere with the nutrition of the epiphysis, and necrosis of the subchondral bone and marrow takes place. The necrotic bone is readily fractured by weight bearing, with resultant deformation of the surface contour. Repair is slow, by means of fibrous tissue replacing the bony fragments. A small amount of osteoid tissue is formed from the fibrous tissue and by the surrounding live bone lamellae, but the blood supply of the region is too inadequate to bring about solid bony replacement. Eventually, as the child approaches adult life, an equilibrium is reached where the blood supply from the diaphysis is able to take care of whatever is left of the epiphysis. Just how long it

takes for the entire involved area to become solid bone can be only surmised. In Konjetzny's second case, bonyre placement was not complete even after eight years, so that it would appear that it occurs very slowly. Symptomatically, however, Konjetzny's case appeared to be completely healed many years before the hip-joint was examined pathologically. It is extremely likely, therefore, that after the process has reached a certain balance between necrosis and fracture on the one hand, and replacement by fibrous and osteoid tissue on the other, pain at least disappears. Likewise, as the joint accommodates itself to the presence of a deformed femur head the limp and limitation of motion disappears. It is at this point that secondary arthritis deformans may well appear. The mechanical factors are certainly conductive to its development. As I mentioned above, many puzzling pathological pictures combining features of both diseases can be explained on this basis.

This whole conception of the nature of Perthes' disease can be carried one step further. If it is dependent upon some disturbance in the blood supply of the head of the femur, it may be brought about perhaps by any process of sufficient severity in the neighborhood of the vessels responsible for the nutrition of the head. Walter's case which showed considerable disturbance of the surface cartilage and loss of the ligamentum teres may have developed Perthes' disease through the previous inflammatory intra-articular process, but in this case one must also consider the extention, application of casts, and other therapeutic procedures employed, as potential sources of trauma.

It should be possible to clear up matters of this kind by experimental work, and indeed such work is already under progress by this author.

SUMMARY AND CONCLUSIONS

1. The resected head of the femur is described in a typical case of Perthes' disease.

2. The pathological criteria for the diagnosis of Perthes' disease are enunciated.

3. Eleven other instances of pathological examinations of heads of the femur in Perthes' disease are abstracted.

4. The various processes held accountable for Perthes' disease are reviewed and evaluated from the pathological data.

5. The theory of vascular disturbance of the femoral epiphysis from trauma is considered the most likely one to explain the pathogenesis of the disease.

The author wishes to thank Dr. Royal Whitman for permission to report this case, and Dr. Paul Klemperer for his valuable criticism of this work.

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OBSERVATIONS ON
LEGG-PERTHES' DISEASE

WITH PARTICULAR REFERENCE TO OPERATIVE TREATMENT*

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NEW YORK

IN May 1926 the patient, a well-developed boy sixteen years of age, was first seen at the Hospital for Ruptured and Crippled. He stated that for several months there had been discomfort in the right limb, of the nature of stiffness and sensitiveness in the hip joint and a persistent limp.

On the assumption that the progression of the deformity might be explained in part by pressure on a weakened epiphysis, which after a time might regain normal resistance, the limb, under anesthesia, was fixed in full abduction by a plaster spica. (Fig. 1.)

The patient lived at a distance and was

FIG. 2. Five months later, showing the progression of the deformity.

FIG. 1. Coxa plana of mild degree. The limb has been fixed in full abduction to relieve direct pressure.

It was noted that the patient was in good condition and that there was nothing significant in the family history. The right limb was flexed and adducted and the movements of the joint were somewhat restricted and painful. The roentgen-ray picture presented the characteristic appearances of coxa plana of a mild degree.

not again seen till the following October. The long spica had in the interval been replaced by a short one which served no purpose other than to check movement in the joint and to restrain the activity of the patient. The second picture shows at this time an apparent atrophy of the structure of the neck at its junction with the epiphysis. (Fig. 2.)

In March, 1927, the patient was again examined. The progression of the deforming disease to what was practically disorganization of the joint is clearly shown in the roentgenogram. (Fig. 3.) It was decided, therefore, to perform the recon-

struction operation. This was indicated by the evident mechanical restraint of abduction, and there was also the incentive that it would provide the opportunity for direct examination of the affected tissues.

On opening the joint it was noted that there was no trace of inflammatory disease, that the cartilage was intact but crumpled, not as if by pressure from without but rather by retraction from within.

It may be recalled that originally the chief significance of this affection was thought to be its differentiation from actual disease of the joint, and that after a period of discomfort, varying from a few months to several years, recovery might be assured with little or no apparent disability.

At the present time this prognosis must be modified. Legg,[1] from an observation of
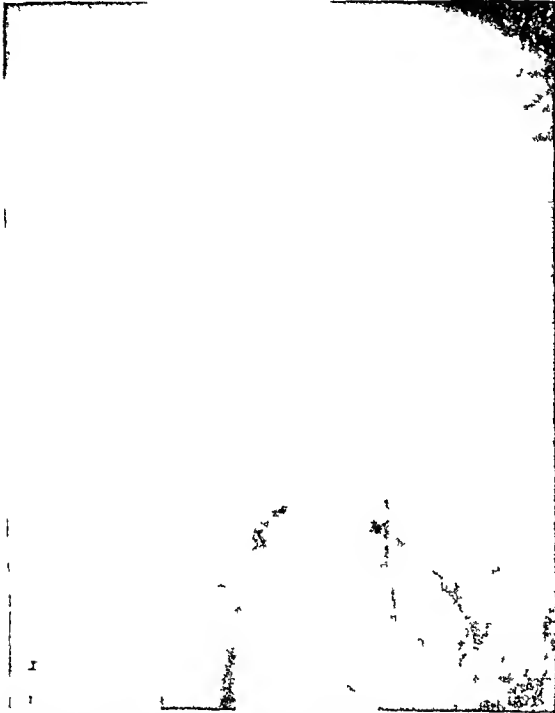
Fig. 3. Ten months after the first examination showing disorganization of the joint Compare with Figure 1.

Fig. 4. After the reconstruction operation. Compare with Figure 3.

The epiphysis was removed, the neck, which seemed solid and resistant, was fashioned into a rounded extremity and the trochanter was transplanted to the outer border of the shaft. The patient left the hospital in June and has not been seen since. (Fig. 4.)

A comparison of the pictures taken before and after the operation will demonstrate the improvement in the mechanical relations. It would seem that as the source of weakness has been removed, and the deformity of flexion and adduction definitely overcome, the functional disability should be slight.

his original cases through a period of many years, now divides them into two classes, a mushroom type in which the area of the head expands as indicated by the name, and the cap type in which the bone center becomes segmented and the epiphysis "migrates" toward the trochanter. In this form the symptoms are more persistent and disability greater. He concludes that treatment has but little influence on the result.

Flemming-Möller[2] from an observation

[1] Legg, A T End results of coxa plana. *J. Bone & Joint Surg.*, 1927, iv, 26

[2] Flemming-Moller. Redundant colon. (In English) *Acta Radiol*, 1926, vi, 432.

of 74 cases states that in approximately 20 per cent there was persistent limp with more or less disability.

It would appear that the prognosis depends in great degree upon the character of the deformity; that the history of coxa plana is not completed in adolescence since as one of the so-called incongruities it may serve as a predisposing cause of arthritis deformans in later life. Consequently in cases like the one described in which the joint is practically disorganized operative intervention may be indicated as a preventive measure.

CORRECTION

IN my article on "Fractures of the Spine" published in the AMERICAN JOURNAL OF SURGERY, August, 1927 iii, 116–125, I stated:

"Others, as Speed, Scudder, Krause, Estes, Elsberg, Frazier, Bottomley, Allen, McWilliams, Taylor, Miller and Coleman, are distinctly in favor of the operation. Of course the skilled neurosurgeon would naturally favor the operation . . . The question of laminectomy is therefore very much disputed but I do not believe that with our limited number of cases we can tip the scales one way or the other. The decision to operate rested, as in every hospital, on the personal opinion of the examining surgeon or the neurologist. Dr. Taylor, our neurological surgeon, was naturally more inclined to the operation."

I have since learned from Dr. Taylor that I have misquoted him. He writes to me the following: "My firm conviction is that very few fractures of the spine should be operated upon and only those where the spinous process and laminae have been fractured and pushed in against the cord as the result of direct violence. It seems to me there is nothing to be gained by operating upon compression fractures of the spine except in very unusual cases that are quite different from the average."

I am anxious to have this correction brought to the attention of the profession to state Dr. Taylor's position correctly and avoid unnecessary operations.

SAMUEL W. BOORSTEIN.

AN APPARENT RECOVERY FROM
MULTIPLE SARCOMA*

WITH INVOLVEMENT OF BOTH BONE AND SOFT PART TREATED BY THE TOXINS OF ERY-
SIPELAS AND BACILLUS PRODIGIOSUS (COLEY)

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STAPLETON, N. Y.

THE patient, Captain G. B., whose age upon admission on June 27, 1925, was 31 years, occupation master mariner, gave the following history: Sustained a bruise of left shin bone February 25, 1918, by being thrown against a hatch. The bruise soon healed and the leg appeared normal within six weeks. Thirteen months later he began to have severe pain at the spot where the skin had been bruised. This pain was accompanied by swelling and fever. The pain, but not the swelling, temporarily disappeared in about one week, followed by recurrent attacks of pain every two or three weeks, for a period of three months, during which time he was making a long voyage from Australia to New York. Shortly after his return to New York a roentgenogram of the leg revealed osteomyelitis of the tibia, and an operation was performed at St. Joseph's Hospital, Paterson, N. J., August 18, 1919. He remained in the hospital until November 23, 1919, and was still suffering pain at the time of discharge and walking on crutches.

He was admitted to U. S. Marine Hospital No. 21, New York, March 31, 1920, and remained until July 26, 1920, during which time he was treated by physiotherapy which relieved the pain. He went back to sea until March, 1921, and then came back to the hospital for two weeks, again back to sea off and on until March 3, 1924, when he was re-admitted to the Marine Hospital, New York, for operation for chronic appendicitis and bilateral inguinal hernia. He was discharged March 28, 1924, recovered of these conditions but still having occasional attacks of pain in the leg.

He was readmitted to the hospital May 10, 1924, and remained under treatment until September 25, 1924, during which time he received baking and ultraviolet rays to the affected leg. After discharge this time all pain had gone; there was no swelling and the patient appeared to be cured.

Figure 1 taken October 2, 1924, shows marked corticle thickening and irregularity of the middle third of the tibia with greater density of the cortex, obliteration of the medullary cavity in the middle third, and marked periosteal roughening with bony projections, especially anteriorly. At this stage the diagnosis was osteomyelitis.

On April 24, 1925 he noticed swelling in the shin bone a little higher up than the site operated on in 1919. He was readmitted to the hospital and operated on in May. Osteomyelitis was found with free pus in the marrow and a sequestrum of dead bone. About two weeks after this operation the bone began to "swell" and ache just below the knee.

Figure 2, taken June 30, 1925, shows marked decalcification of the upper third of the left tibia with only part of the skeleton of the bone remaining, appearing like a bone desolving under corrosive fluid in the anterior upper third of the tibia. Shortly afterwards injections of sodium

*This case was reported in *Military Surgeon*, July, 1927 (lxi, 42–47), but in view of the fact that it is of such unusual interest, we have decided to republish it in full with the important roentgenograms and microphotographs which were not included in the original report.

iodide were begun and given every third day intravenously until a total of fifty grams were given. Figure 3, made September 13, 1925, shortly after the sodium iodide treatment, shows further advance

of bone was removed which was reported by the laboratory as myelosarcoma, very cellular, with slight fibro-sarcomatous structure: Figure 4 is a section through tumor of tibia. Fixation is in formalin 10

FIG. 1. October, 1924. Marked cortical thickening and irregularity; obliteration of medullary cavity; periosteal roughening. Diagnosis at this time: osteomyelitis.

of the erosion, with pathological fracture at the junction of the upper and middle third of the tibia, anteroposterior and lateral views.

On September 11, 1925, a small piece

per cent. The growth is composed of a mass of cells without regular arrangement. The cell units are small, polyhedral, with indistinct borders, often appearing as a syncytium. They are very uniform in size.

The cytoplasm is clear and stains poorly. The nuclei are generally oval, with one, two or three distinct chromatin granules. Mitotic figures are frequent. Strands of fibrous tissue pervade the growth, in some areas more conspicuous than in others. Blood vessels are not numerous.

was reported by the laboratory as myelo-sarcoma metastatic. Figure 6 shows section through lymph-node in mid-line of abdomen, just above umbilicus. Fixation is in formalin 10 per cent. The normal structure of the lymph-node is entirely broken down replaced by the irregular masses of invad-
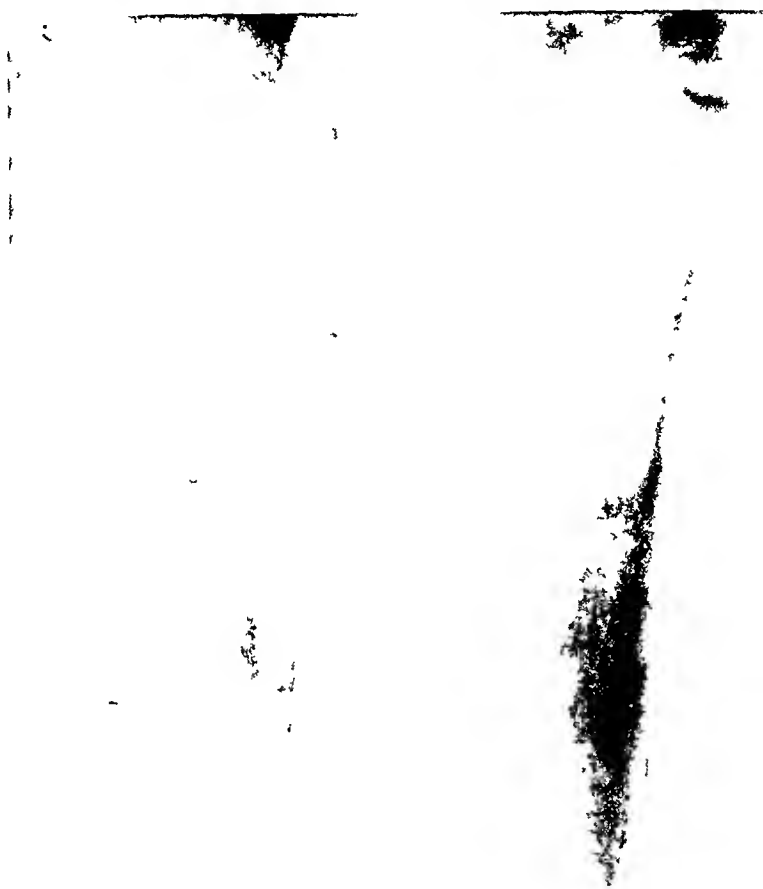
FIG. 2. June 30, 1925, shows marked bone destruction or loss of calcium; condition now begins to resemble a sarcoma rather than an inflammatory process.

Amputation of thigh in middle third was performed September 21, 1925. The wound healed in two weeks.

The pain in the stump continued. Figure 5 of the stump of the left femur 60 days after amputation, shows the periosteum intact, the cortex and medulla sharply demarcated. On December 12, a nodule was noticed beneath the skin just above the umbilicus, a specimen from which

ing tumor cells which resemble those of the growth on the tibia. Lymphocytes are intermingled in places with tumor cells. Ewing Taylor was the pathologist.

January 5, 1926, the patient presented the following conditions: The end of the femur-amputated stump had a tumor mass about the size of a man's fist on its inner aspect, with an additional growth about the size of a lemon, over its outer aspect.

The skin of the stump appeared quite healthy. There was a mass of new growth in the left inguinal region which was about 2 inches long, 1 inch wide and 2 inches thick. There was a supraumbilical mass which involved the skin. This mass was about ¾ of an inch in diameter. The

quite severe (Chart A). Subsequent series of injections after the patient had established tolerance for Coley's toxins, did not produce such reactions, even with large doses (Chart B).

On January 22, the circumference of the stump was 17⅛ inches. The mass in the
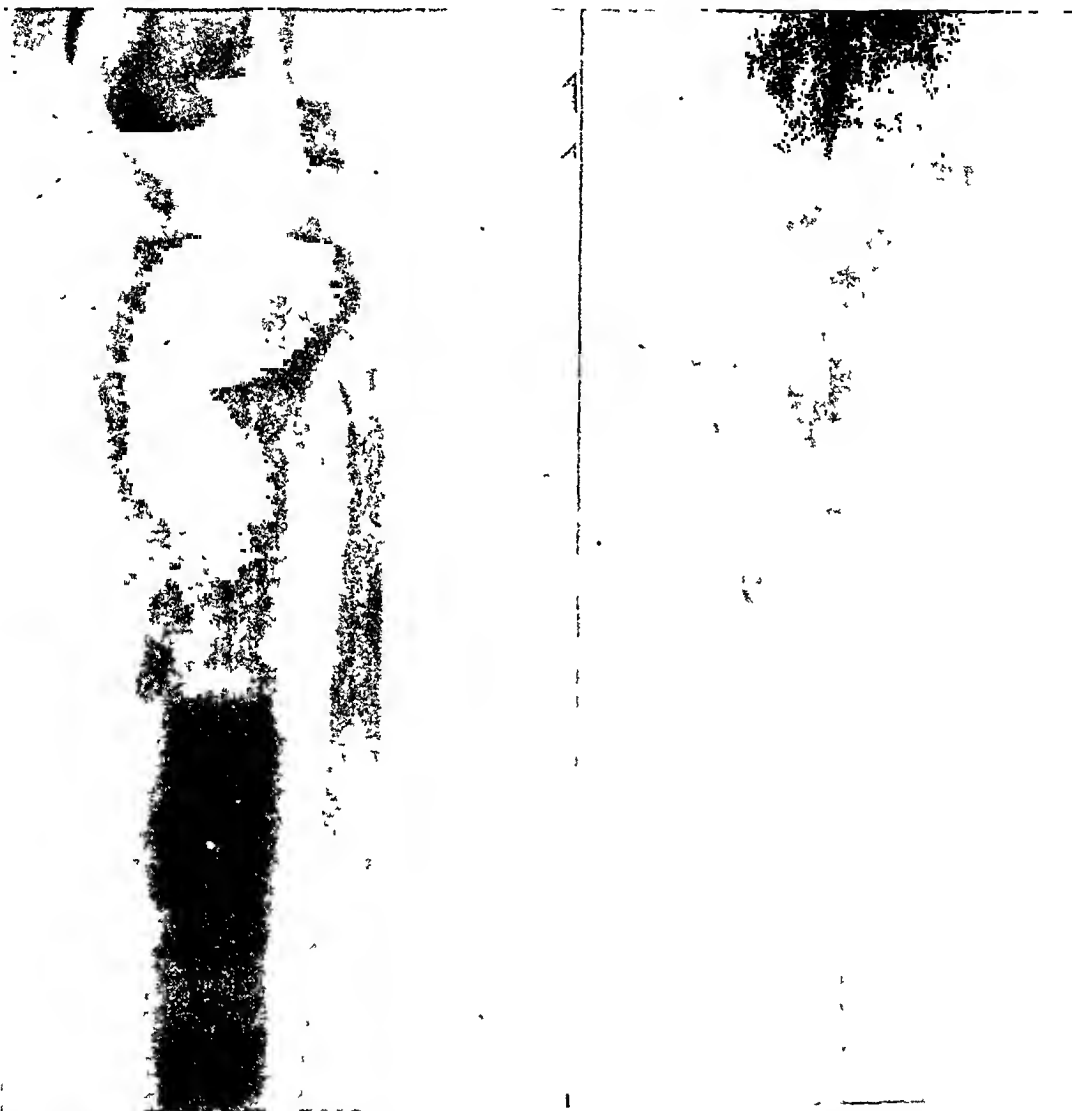
Fig. 3. September 13, 1925, shows rapid extension of the process with pathologic fracture; and now the evidence in favor of a neoplasm is unmistakable. The picture is quite characteristic of the endothelial myeloma type (described by Dr. Ewing).

circumference of the stump was 19 inches.

Injections of Coley's toxins were begun, the dose ¼ of one minim. This dosage was increased ½ minim daily until the patient was receiving 6½ minims. Temperature reactions following injections were

groin had disappeared. The supraumbilical mass was decidedly smaller, softer and lighter in color. The patient looked paler no doubt due to severe reactions following injections. His weight was 117¾ pounds. The injections were held at 6½ minims from January 25 to February 2, 1926, when

they were increased 1 minim a day until the patient was receiving 18 minims daily. On February 20 they were discontinued because of extreme weakness of the patient. At this time the stump had taken on new

of Coley's toxins were injected directly into the tumor mass on the stump. The dosage was gradually increased each day until April 7, at which time he was receiving five minims directly into the tumor.

CHART A

TREASURY DEPARTMENT,
PUBLIC HEALTH SERVICE.
Form 1916 E.

CLINICAL RECORD.

GRAPHIC CHART, TEMPERATURE, ETC.

September October 1926

SURNAME B   GIVEN NAME G
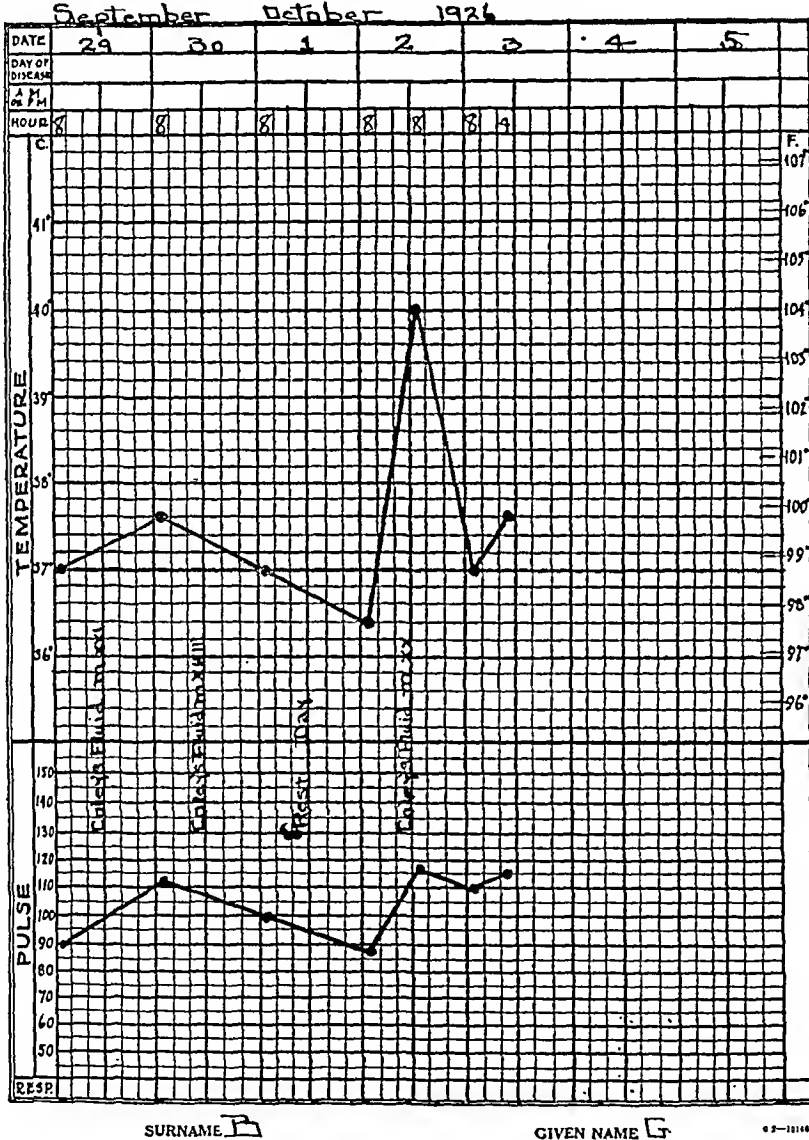
growth, associated with considerable edema of both good leg and stump.

On March 17 there were three small vesicles on the end of the stump. The supraumbilical growth had increased considerably in size and was now the size of a large lemon. On March 27 two minims

Each injection was followed by considerable temperature reaction. Figure 7 taken February 23, 1926, shows the stump of the femur undergoing dissolution. There is hardly a skeleton of the cortex seen with the bony substance, primarily the calcium, disseminated into the soft structures in all

directions, as if transported by the lymphatics and veins.

On May 5, 1926, several small nodules were felt under the skin of the abdomen. During May and June the patient grew

the circumference of which was 31 inches. The end of the stump had broken down over an area about 5 inches in diameter, from which there was a foul, profuse, ichorous discharge.

CHART B

CLINICAL RECORD.

GRAPHIC CHART, TEMPERATURE, ETC.

TREASURY DEPARTMENT,
PUBLIC HEALTH SERVICE.
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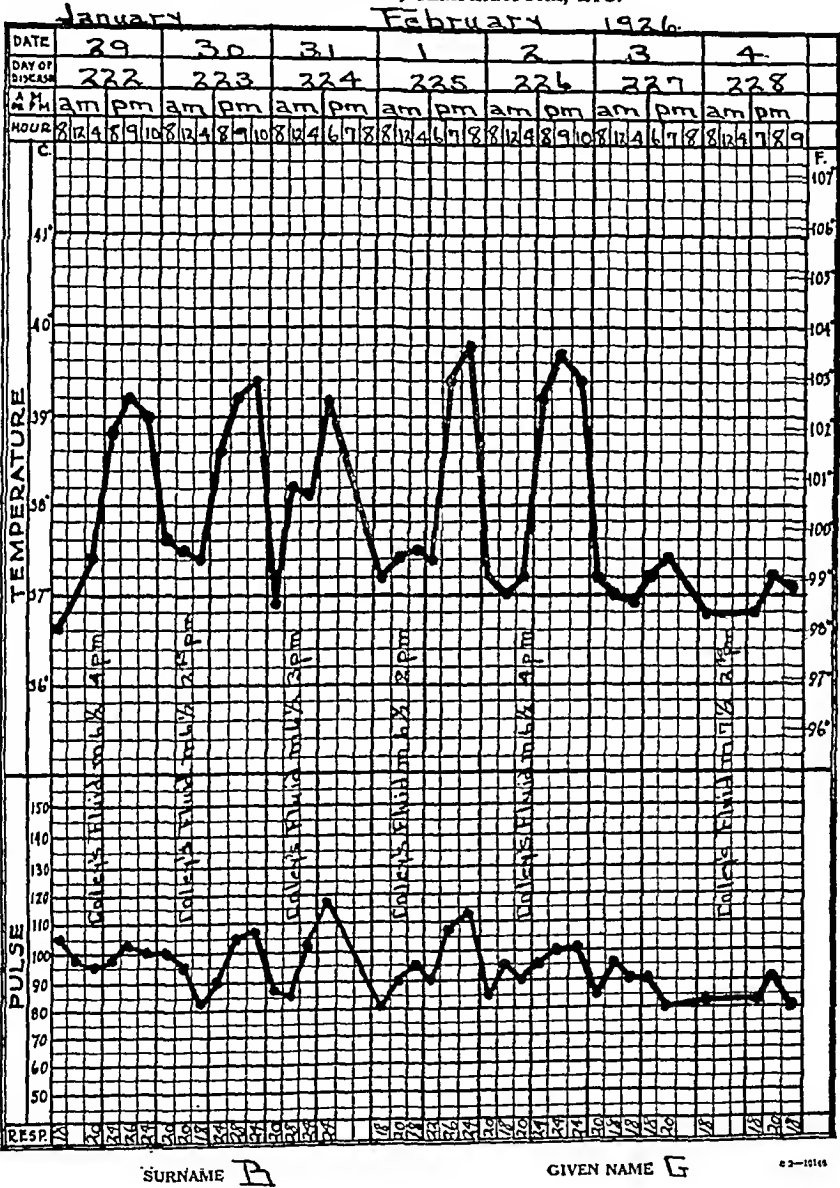
steadily worse with metastatic growths appearing in many parts of the body, among which was considerable involvement of the right clavicle and multiple tumors in the scalp, cranial bones, and cervical vertebrae.

About this time the maximum growth of the tumor in the stump was attained,

On August 5, 1926, Coley's fluid was again begun with a dosage of two minims and increased a minim a day until he was receiving 17 minims at a dose. The dose was held at this point until September 4. By this time improvement was marked; edema of the good leg and the stump had

decreased very much and the stump had almost healed. The supraumbilical mass had practically disappeared; areas of involvement of the scalp had disappeared, the clavicular tumor had decreased considerably in size.

An additional series of injections was begun September 19 and continued for three weeks.

On November 22, the general condition

FIG. 4. Microphotograph of specimen of bone removed at exploratory operation on Sept. 11, 1925.

of the patient was excellent, weight being 147 pounds. The stump was 17 inches in circumference, a reduction from 31 inches in May. The old discharging wound of the stump was entirely healed, the skin quite leathery and underlying it was a tough fibrous mass believed to be scar tissue. Growths on the abdomen had disappeared. Just above the umbilicus there was an area of pigmentation of the skin which was 3½ inches long by 2½ inches wide and corresponded to the site of the former tumor. Areas of involvement

in the scalp and skull could no longer be discerned. There was still present some degree of thickening and roughening of the right clavicle.

The pathological diagnosis of sarcoma was concurred in by Drs. Ewing Taylor, James Ewing, and E. A. Codman. The roentgenological diagnosis was made by Dr. Frank Liberson.

The patient was discharged from the

FIG. 5. Stump of femur on Nov. 25 or sixty days after amputation. No evidence of recurrence.

hospital apparently recovered, December 5, 1926.

At our suggestion the patient returned to the hospital February 13, 1927, for further treatment. Every third day he was given injections of Coley's toxins, beginning with 3 minims and the amount doubled each time, until 30 minims were given at a time. He was discharged March 27, 1927, in good condition.

He again returned to the hospital, according to suggestion, from October 23, to December 7, 1927, and was given Coley's toxins every third day up to 30 minims.

The patient was last examined January 9, 1928, at which time there was no evidence of disease present. There still remained as evidence of former disease, scarring, discoloration and slight thickening of skin over stump and abdomen (in
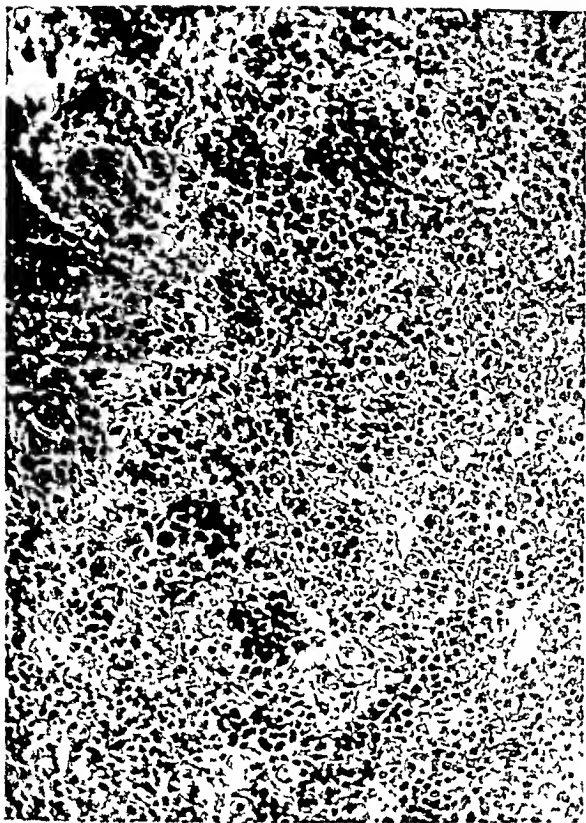
Fig. 6. Microphotograph of section from a metastatic tumor beneath the skin just above the umbilicus, removed on Dec. 12, 1926. Diagnosis: myelosarcoma, metastatic.

Fig. 8. Shows the condition of the femur and stump at present, Jan. 8, 1928, two years after the beginning of the toxin treatment and fourteen months after the disappearance of the metastatic tumors. Shows the marked new bone formation replacing the bone destroyed by the tumor.

Fig. 7. Feb. 23, 1926, shows very extensive recurrence in stump and femur, with marked destruction or dissolution of bone extending nearly to the trochanter.

areas corresponding to former tumors) and slight thickening and roughening of the right clavicle, all of which appeared to be scar tissue and was essentially the same as conditions above reported November 22, 1926. His weight was 143 pounds.

Figure 8, taken January 9, 1928, shows the appearance of the stump at the present time. The photograph of the patient was taken January 9, 1928. (Fig. 10.)

On December 1, 1927, the patient was presented at the clinical conference at the Memorial Hospital, New York. The discussion at this conference by Dr. Coley follows:

COMMENTARY BY DR. WILLIAM B. COLEY OF NEW YORK

I am greatly indebted to Dr. Christian and Dr. Palmer for permitting me to present their patient at the staff-conference

of the Memorial Hospital on December 1, 1927. At this time the patient was apparently in the best of health; he had gained more than forty pounds in weight; and careful examination failed to reveal any evidence of the numerous metastatic tumors that were present in the bones and soft parts when the toxin treatment was

am almost certain that I should not have continued the treatment after three months when not only no improvement had been noticed but marked increase had taken place in the metastatic tumors and especially in the recurrent tumor of the stump (an increase of from 17 to 31 inches). In the second place, I am quite sure that
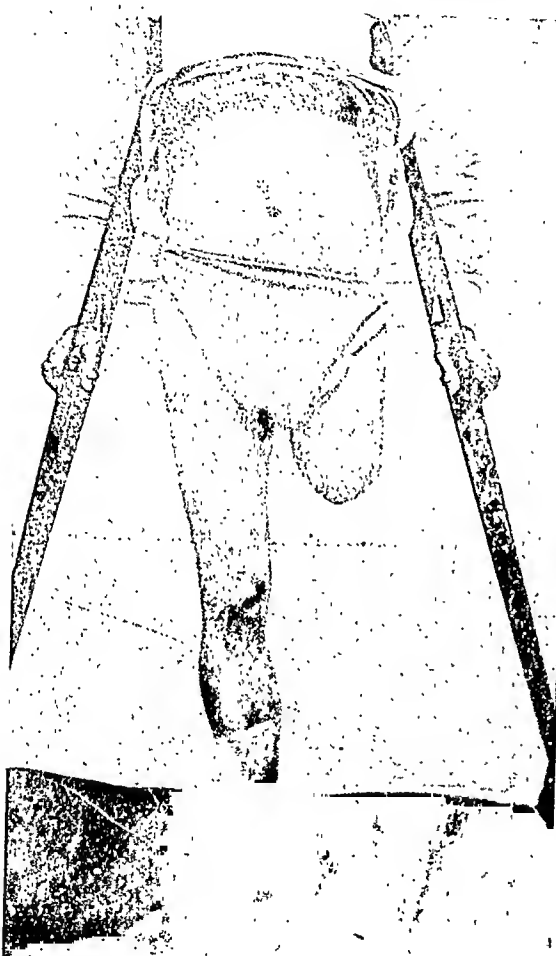
FIG. 9. Condition on Jan. 8, 1928, or two years after beginning toxin treatment. Stump entirely normal; and roentgenogram shows no evidence of disease.

FIG. 10 showing condition of patient on Jan. 8, 1928, two years after beginning treatment and fourteen months after disappearance of multiple metastatic sarcoma of stump of femur, skull, elavielc and soft parts of various regions.

begun. More than a year has elapsed since the last follow-note was made in the original report.[1]

I believe this is one of the most remarkable cases of malignant tumor of the long bones that has ever been published, and I am quite willing to admit that, had the patient been under my care, he would probably not be alive today. In the first place, I

I should not have dared to increase the dose to such a large amount (30 minims). However, it was not until these large daily doses were given that the improvement was noted, which improvement continued until all the tumors had disappeared. I have learned more from this one case than from any other that I personally have treated, and I feel that many of the past failures might have resulted otherwise had larger doses and more frequent injections of the toxins been given.

In view of the roentgenogram findings, the microphotograph and the type of multiple metastases that involved both bones and soft parts, I believe we are warranted in placing this case in the group of endothelioma or endothelial myeloma (so fully described by Dr. Ewing).

This case of Dr. Christian and Dr. Palmer together with the remarkable case of Dr. Howard Lilienthal, presented at the meeting of the New York Surgical Society in December, 1926,[2] prove that it is possible to cause the complete disappearance of a far-advanced inoperable sarcoma with extensive multiple metastases, by systematic injections of the mixed toxins of erysipelas and Bacillus prodigiosus, without radiation or any other form of treatment.

While too short a time has elapsed in the first case to permit it being classed as a "cure," Dr. Lilienthal's patient is well now three and two-third years since the treatment was begun. This case is almost as remarkable as the one under discussion. While Dr. Lilienthal describes it as an inoperable mediastinal tumor, on exploratory operation he found extensive involvement of the ribs and spine; and from these findings, as well as the clinical history, I am inclined to believe it to be, more probably, a primary sarcoma of the spine and ribs with secondary metastasis in the mediastinal glands. At any rate, the child had a large, inoperable tumor of the mediastinum with involvement of the ribs and spine, resulting in complete paraplegia. At the time the treatment was begun, the case was regarded as entirely hopeless by every surgeon who had seen it. Under a very short course of toxin treatment covering a period of three weeks during which only eleven injections were given, the child made a complete recovery and is well at the present time. In this case, no radiation or other form of treatment but the toxins was given.

It is very fortunate that in both of these cases the diagnosis was confirmed by a number of eminent pathologists, including Dr. James Ewing.

I believe that these two cases, published within a few months of each other, furnish sufficient answer to the criticism often made in the earlier years and not infrequently in recent years that other surgeons have been unable to obtain the same results from the method (toxin treatment) as I have. Those who are interested in the results obtained in various types of bone sarcoma, are referred to my paper recently published in the *Archives of Surgery*.[3]

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VALUES OF

PHYSICAL THERAPY

IN THE CLINIC*

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FROM a haphazard and empirical form of treatment, physical therapy has gradually emerged within the past ten years, to take its place as a valuable and rational adjuvant to the usual medical and surgical methods. Mankind has apparently always appreciated the values of light and heat as pain-relieving and tonic agencies; but since within a generation intensive study has been accorded them the rational and scientific reasons for their administration are becoming known. The spectrum has been divided into its component parts, the wave lengths have been measured, the physiologic action of each has been studied, and the shorter wave lengths of the upper spectrum have begun to be utilized, and science has gone beyond into the angstrom units of ultra-violet rays. At the other end of the spectrum are the long, heating wave lengths of the infra-red. These supposedly more penetrating rays are utilized for their relief of pain and effect on circulation. By the agency of convective heat, peripheral circulation is increased and the acceleration of the blood stream promoted, thus facilitating the process of repair of injured and diseased tissue, as well as increasing the resolution and elimination of inflammatory products. The bactericidal effects of heat and light are well known, and in physical therapy are found effective weapons for combating disease, and hastening the process of repair.

The more penetrating forms of heat, generated by means of the high-frequency current, are called conversive; the resistance of the tissues to the passage of the high voltage, low amperage and rapidly oscillating current generates within the tissues the deep-seated heat known as diathermy. Medically it is used to heat tissues, superficially or deeply, within physiologic limits; surgically the current in the active electrode may be so concentrated that destructive effects are produced. This is called surgical diathermy; it has a well-defined place in many forms of surgery. The removal of accessible neoplasms, benign or malignant, is quickly and safely brought about by the desiccating current. Blood and lymphatic vessels are sealed in the process, and metastasis from malignant areas is much less likely to occur.

Massage, active and passive exercise, and hydrotherapy all have their indications in many painful and diseased conditions. These methods, however, must be employed with intelligence and caution, the underlying pathologic condition always being taken into consideration. Massage is a pain-relieving agent; it stimulates circulation, promotes absorption, relieves stasis, cleanses the skin, and has an action

on peripheral as well as deep-seated nerves. Its action on muscles is profound; warmth is promoted, and increased nutrition of the muscle substance is brought about, and this without nervous expenditure on the part of the patient. Hence, in weakened and debilitated conditions, convalescence is much hastened. Massage is really a form of passive exercise, and although it does not take the place of active exercise, it fills a need in a large group of cases.

The physical therapy in cases of fractures has been one of the outstanding methods in modern surgical practice, and is certainly radically different from the methods of even a generation ago. In the older methods of treatment a fractured member was placed in splints or casts for six or eight weeks, and neighboring joints were kept immovable; this was always followed by serious loss of function, and many additional weeks were required for the restoration of the atrophied muscles and ankylosed joints. By careful application physical therapy for many fractures may be begun within a week of the initial accident, or even sooner. Utmost care, of course, is necessary; but gentle massage, the application of radiant or infra-red heat, diathermy, and careful active exercises may all be practiced with good results. Thus along with the repair process of the bone, function in joints and muscles is increased concomitantly, and convalescence is much shortened and the chances of complete recovery are greatly improved. In recent fractures, when bony union is just begun, passive exercise should not be instituted. When exercise is indicated it should always be the active form; that is, the patient should be encouraged to attempt movement of his own volition, hence he will always stop short of damage or pain. Those movements which he can do with little or no pain are generally valuable in keeping up the tone of the muscles and in preventing adhesions in tendons and joints. Excessive passive motion, by the hands of an operator, should be avoided in recent cases.

Among painful inflammatory conditions which are benefited by radiant heat and light and diathermy are (1) myositis; heat and massage seem especially indicated; (2) synovitis and bursitis; diathermy, with the electrodes placed as nearly as possible on opposite sides of a limb, is a valuable form of treatment; it should continue for from twenty to forty minutes; (3) orchitis and epididymitis; diathermy with the Corbus scrotal electrode seems to give marked relief in most cases; the treatment may last forty minutes, and be given two or more times a day; (4) arthritis; the traumatic type seems to respond more readily than the chronic type of hypertrophic arthritis; but even in the latter, improvement results if possible foci of infection are removed. Relief from pain and greater mobility of joints usually follow after a course of diathermy.

Sprains respond well to radiant heat and light and diathermy, followed by massage. Fixation by adhesive strapping may be necessary for a brief period, but should not be too long applied. Active exercise and movement short of excessive pain should be begun early, to prevent uncomfortable fibrous adhesions around the joint. If there is extensive hematoma in deep contusions, heat with light massage is preferable to diathermy in the early stages. Diathermy is of value in the later treatment, and seems to be conducive to the absorption of blood clots and reduction of inflammatory changes. If it is instituted too soon, hemorrhage may be increased. In the old cases, massage may be more vigorous.

The ultraviolet rays from the mercury arc are of decided value in the treatment of many dermatologic conditions. In acne the initial dose should be such as to produce decided erythema, with subsequent exfoliation. In many cases the results are remarkable. Conditions of herpes zoster respond well to ultraviolet irradiation. Indolent ulcers and infected areas are improved by the application of the rays from the water-cooled lamp. Care should be taken in cases of recent granulation to avoid destruction

by overdose. General body irradiation has apparently a very tonic effect, increasing and fixing the calcium and phosphorous content of the blood. Hence in case of rickets and tetany ultraviolet light treatment seems almost specific. Radiation from the sun and artificial sources seems especially beneficial in so-called surgical tuberculosis, especially in tuberculosis of bones, glands, and peritoneum.

It is impossible in a short paper to emphasize all the forms of physical therapy which find their places in any clinic. It is unnecessary to stress the importance of careful diagnosis and knowledge of the physiologic effects of the various physical agencies. We know, of course, that none of the methods is panacea, but simply a means of assisting nature in the processes of repair. These agencies must be used carefully and discriminatingly, and physical treatment should be under the direction of a medical man who has made special study of the methods employed. The Council on Physical Therapy, appointed by the American Medical Association, is doing a splendid work in separating the wheat from the chaff, and the result of its work will be, no doubt, that physical therapy will be placed on a rational and scientific basis. This is a "consummation devoutly to be wished."

SOME REMARKS ON

THE PREOPERATIVE, OPERATIVE AND POSTOPERATIVE TREATMENT OF BENIGN PROSTATIC HYPERTROPHY*

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MUCH has been written during the past few years on prostatic hypertrophy. All its phases have been discussed, so that I propose to discuss briefly some of the factors in the surgical management of benign prostatic hypertrophy which have produced very gratifying results, with special emphasis on some of the fundamental principles.

MORTALITY

The urologist in coöperation with the internist and physiologic chemist has according to Young[5] succeeded in lowering the general mortality of prostatectomy from 20 per cent twenty years ago to 2 or 3 per cent today, the most striking result I believe that has been shown in any branch of medicine or surgery. Many authors during recent years have reported large series of cases with few deaths. Young[6] reported 198 cases with one death, Davis a series of 107 cases with only one death. Such results can be obtained only by the strictest attention to details in the management of these cases and by coöperation with other specialists.

PREOPERATIVE TREATMENT

Preoperative treatment and rest in selected cases for two or three days prior to the operation if it is to be done by the two-stage suprapubic method or even prior to the institution of catheter drainage, afford time for a thorough study of the cardiovascular and renal systems. The internist is called on to give an opinion as to the patient's general condition; particular attention is given to focal infections so that they may be eradicated before any operative procedure is carried out. Most of these patients are usually partially dehydrated on presenting themselves so that the institution of bladder drainage whether by suprapubic cystotomy or catheter must be done with great care as dehydration may be easily carried beyond the stage of repair in spite of the administration of water by any method.

Fluids should be forced and here again it is the internist who decides how much fluid the myocardium can tolerate. The myocardium should be watched carefully and digitalis in sufficient dosage administered when indicated. Patients with hypertension stand the operation well but patients with low blood pressure should be carefully watched; they often have myocardial defects and chronic focal infection elsewhere than in the genitourinary tract. These patients easily become anuric. Forced fluids and the administration of $\frac{1}{30}$ grain strychnin sulphate three times daily together with digitalis are usually productive of good results. The patients generally are put on a low purin diet and in addition those with hypertension if it is producing symptoms are given a salt-free diet.

URINARY ANTISEPTICS

Some form of urinary antiseptic is usually administered; if the urine on admission is alkaline, 1.5 grains acriflavin (Boots) twice daily for five or six days

followed by 10 grains each of urotropin and sodium acid phosphate four times a day are generally the most satisfactory. The patient who on presenting himself has a moderate or large amount of residual urine with only a few pus cells should be carefully watched since infection is so likely to follow any operative procedure. The urine in these cases usually contains a Gram-positive coccus so that the use of hexylresorcinal is of value.

If marked cystitis is present the irrigation of the bladder twice daily with hot tonic solution of sodium chlorid or potassium permanganate followed by the institution of 1.0 per cent mercurochrome or 10 per cent argyrol renders the bladder more tolerant to the suprapubic drain and in many instances to the indwelling catheter.

In spite of everything, however, we all see occasionally a case of unexplained bladder spasm following the institution of drainage. This distressing complication has been known to overtax the patient's resistance so that death results.

METHOD OF OPERATION

The choice of the method employed depends on the operator's experience and the selection of cases. Equally good results are obtained in both the perineal and the suprapubic methods. Hunt in discussing the choice of operation states: "An unprejudiced analysis of the ultimate functional results and mortality rate following both methods of operation by those experienced in them, shows that these indexes of merit can no longer be utilized to discredit one or the other method."

My experience has been limited almost entirely to the suprapubic method; the mortality has been low and the functional results have been good. It is not within the scope of this paper to discuss when a one-stage or two-stage operation should be employed. That is a point which must be answered in each individual case; generalization cannot here be applied.

ANESTHETIC

The choice of the anesthetic agent employed is of vital importance to the patient. Since with this class of patients the cardiovascular-renal systems are practically always impaired in varying degrees, it follows that any anesthetic agent which produces further impairment of renal function cannot with safety be employed. Laboratory experiments and clinical experience have taught that ether impairs renal function so that its use by urologists in prostatic surgery has been practically abandoned. Caudal and sacral block anesthesia are suitable for perineal operations, but they must be supplemented by abdominal block for the suprapubic cases. In the hands of most men who have employed this type of anesthesia excellent results have been obtained. My experience with spinal anesthesia has been limited. In the few cases in which it was employed the results were excellent. Anuria and grave cerebral complications I believe are likely to accompany the drop in blood pressure which occurs with spinal anesthesia. Since it has been shown, notably by Ockerblad and Dillon, that ephedrin can be satisfactorily employed to combat the changes in blood pressure during spinal anesthesia I believe that with the proper evaluation of the technic in its employment spinal anesthesia will soon find a permanent place in prostatic surgery.

Personal observations extending over a four-year period on the use of nitrous oxid and oxygen, and during recent years on ethylene gas, lead me to believe that these are in most instances the anesthetics of choice. I have never observed any untoward results from their use and consider them reliable and safe anesthetic agents when properly administered.

Local anesthesia of the infiltration type usually suffices in most cases of suprapubic cystotomy. In the very fat, the short fat, and the nervous and apprehensive persons nitrous oxid and oxygen is a more practical type of anesthetic. It has been shown

beyond question that psychic shock is a factor in the production of surgical shock. If a patient who is to have suprapubic cystotomy is extremely nervous and apprehensive I believe in employing gas anesthesia from the start rather than to begin the operation with local anesthesia and then resorting to gas. The psychic shock I am sure is less and the operation is carried through from beginning to completion without interruption.

Recent experiments and reports by Cabot and Ransom show that the effect of ethylene gas on renal function is minimal, no more probably, than the effect of the operation itself regardless of the anesthetic employed. It produces sufficient relaxation of the abdominal muscles, therefore its only objectionable features would be the occasional severe postoperative nausea which I have noted and the technical difficulties in its administration; the latter, however, have been overcome in most hospitals. One of the greatest objections to nitrous oxid-oxygen anesthesia has been that there is insufficient relaxation; if sufficient relaxation for the proper performance of the operation cannot be obtained with nitrous oxid and oxygen anesthesia, ethylene is employed; this simply means the substitution of one gas for the other.

DRAINAGE

Drainage is to be considered as one of the most important factors in the management of these cases. It should be adequate and complete. If drainage is to be done by means of the indwelling catheter one of the types of catheter especially devised for this purpose should be used since adequate and comfortable drainage cannot be obtained with the ordinary type of rubber catheter.

For drainage by suprapubic cystotomy the Pezzer types of tube are suitable. I prefer the angle type to the straight. Kinking and the dragging sensation of which the patient sometimes complains do not occur. For those cases in which cystitis is marked and a great deal of mucus is present the angle, double Pezzer tube is most satisfactory. Thorough irrigation of the bladder can be accomplished with little discomfort to the patient. I believe it is unnecessary to use a tube larger than a No. 38 French. Ample drainage with smaller tubes can be obtained and there is not the softening and necrosis of the tissues of the abdominal wall surrounding the tube. In using these tubes leakage is reduced to a minimum. The patient remains dry and comfortable. Because leakage is reduced to a minimum, dependable phenolsulphonephthalein functional tests can be carried out. The opening in the bladder should always be made as high as possible; this greatly facilitates closure of the fistula. Gentleness should be exercised in pushing back the peritoneal fold from the surface of the bladder. The degree of postoperative distention is to a great extent dependent on the gentleness with which this fold is pushed back from the bladder. If much distention occurs and is not relieved by enemas, physostigmin hypodermically in full doses is employed. If the patient's blood pressure is low, pituitrin is used; this raises the blood pressure and aids in renal secretion.

It is, of course, a well-known fact that blood chemistry studies on these patients show a retention of nitrogenous products in varying degrees. With the institution of bladder drainage, the retention of these products gradually diminishes and the phenolsulphonephthalein output gradually increases. Drainage should be continued until the patient's condition becomes stabilized and in my experience it requires an average of from ten to fourteen days. Drainage should be of long enough duration to allow for a return of bladder function. The greatly distended bladders and distended ureters must be allowed to regain their tone. Pyelitis is often the result of improper preparation of the bladder before prostatectomy.

If aversion to water develops during the preoperative and drainage periods the

patient is provided with glucose sugar candy; this furnishes readily oxidizable sugar and produces thirst.

HEMOSTASIS

Complete hemostasis of the suprapubic wound at the time of operation renders infection less likely. A small cigarette drain should be inserted into the space of Retzius. This drain should be gently inserted so that the bladder is not separated from its anterior attachments; this would leave a pocket as a trap for infection. Closure of the fascia with interrupted sutures of No. 2 chromic catgut permits the patient to be up and around on the second or third day without fear of herniation.

Hemostasis at the time of enucleation of the prostate is the second most important factor in the management of these cases. Complete hemostasis is secured first, by exercising gentleness and care in the enucleation and, secondly, by the use of some mechanical measure.

The Hagner and Pilcher bags are useful mechanical devices, but I prefer the gauze pack. The gauze is soaked in glycerin and packed tightly into the gland cavity; the pack is removed fractionally during the next twelve or twenty-four hours. I have never seen alarming hemorrhage following the use of the pack. The pack, of course, causes the patient some discomfort, producing a more or less constant desire to void. This annoying symptom is easily controlled by dram doses of tincture of hyoscyamus every three hours, or if this does not suffice, morphin in small doses.

If a bag is to be used I favor the one designed by Barry. After deflation it can be left in place without causing any more discomfort than an indwelling catheter. If bleeding occurs the bag can be reinflated. It is withdrawn through the urethra and not through the suprapubic incision as are the other bags. The materials necessary for its construction are always at hand: a 24 F catheter and a piece of thin rubber tubing such as is used for making a cigarette drain.

A single, angle Pezzer tube is inserted into the bladder after the pack is removed and as the wound closes, smaller tubes are inserted; the patient is kept dry. Bladder irrigation is commenced about the fourth or fifth day. At this time the clots begin to separate and the bladder is kept much cleaner. The use of the indwelling catheter to facilitate closure of the sinus and to provide better drainage following prostatectomy is a rational procedure. Irrigation of the bladder through the catheter followed by the instillation of mercurochrome aids in preventing infection. The indwelling catheter must be inserted and handled with care as in my experience epididymitis is more likely to follow its use than in those cases in which it is not employed.

EPIDIDYMITIS

Epididymitis occurs frequently as a troublesome complication and in most cases it greatly retards convalescence. I have never seen a fatality and in only one instance suppuration. However, it is a formidable complication and every means should be taken to prevent it. It may occur before operation, following repeated catheterization; it may occur after operation or several weeks postoperatively. In the first instance it is the patient who has been leading a catheter life who presents himself with this complication. Active treatment as support, ice bags, and the intramuscular injection of foreign protein usually suffices. Sodium iodid and urotropin intravenously gives marked relief in some cases.

Double ligation and section of the vasa preoperatively have in the hands of some reduced the incidence of this complication from an average of 20 to 4 per cent. This is a relatively simple procedure and I believe it should be recommended to all patients who are to undergo prostatectomy.

SUMMARY

Management of surgical prostatic cases during the past few years as it has been

practiced by urologists has resulted in lowering the mortality comparable with that for many operations which are performed on younger and stronger persons. Since the average age of patients in the usual group that comes for prostatectomy is seventy years, and the average mortality is 3 per cent, I feel that this major operation can be unhesitatingly recommended as a safe procedure.

Adequate bladder drainage and complete hemostasis are to be considered as the two chief factors contributing to this low mortality.

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THE FUNCTIONAL TESTS OF THE LIVER*

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GRADUALLY one after another as the result of clinical and laboratory research, various organs of the body are emerging from a position of obscurity. Previous conceptions are necessarily being altered, teachings which have passed unchallenged for decades are being revised as a result of the rising tide of investigation into the intricacies of the diseases of man. Nowhere does this apply more than to that varifunctioning organ, the liver, closely allied as it is functionally to every other organ in the abdomen. In spite of its most important and complex rôle, the functional clarification of the liver in both health and disease has been extremely slow. Facts of one kind and another are just now beginning to be unraveled and fitted in here and there wherever they may belong until gradually a more understandable and workable concept of the liver is being evolved. The goal is still distant, however, although the achievements of many in as many different fields have developed a close relationship to each other and have been the means of establishing a basis for further progress. How true it is that many of the present-day procedures are revisions or modifications of methods conceived in years past. So too some of the present means of investigation, interesting though shorn of any great usefulness, may become of utmost importance when linked with future possibilities.

A slight resumé of the many functions of the liver may make for a better understanding of the various tests which are at the command of the investigator. Metab-olism of sugar is one of the functions in which the hepatic cell plays a part; the cell converts sugar to glycogen and stores it as such and then as occasion arises the glycogen is redistributed to the body as sugar. Mann[3] has shown clearly that following removal of the liver in the dog there is marked and progressive decrease in the sugar of the blood, explainable on the possible grounds that hepatectomy produces depletion in the carbohydrate material of the body either directly by removal of the store of carbohydrate and its plan of elaboration or indirectly by removal of a substance which has to do with carbohydrate utilization. He has also shown that the decreasing blood sugar and concomitant symptoms following such a procedure can be combated by injections of glucose. Clinically, however, even in cases with marked and destructive hepatic disease it is rare to find hypoglycemia.

The formation of urea from amino-acid nitrogen is conducted by the liver, as demonstrated by Mann.[4] In the dehepatized animal no measurable amount of urea is formed.

The liver has a rôle in the metabolism of cholesterin, fat, and iron and in the production of fibrinogen. It is a great detoxicating organ.

The last important function of the hepatic cell has to do with bilirubin: its reception, formation, and excretion. This pigment is derived from hemoglobin with hematin as an intermediary product and is found normally in the blood serum of man in small amounts.

BILIRUBIN AND ITS FORMATION

Mann has demonstrated that most of the bilirubin is manufactured by the reticulo-endothelial cells especially of the bone marrow. Although bilirubin is made in the liver and spleen the amount is insignificant as compared with that made in the bone marrow. However, there is more bilirubin in the spleen than in the liver, but it can be formed at its normal rate in the experimental animal in the absence of these two organs.

Mann has also shown that following dehepatization in the dog, jaundice occurs, which would clearly indicate that the pigment was formed elsewhere than in the liver, and that the liver acts primarily as an excretory organ for bilirubin, and only secondarily and to a small degree as a formative organ.

There has been a diversity of opinion regarding the similarity or dissimilarity of the bilirubin of obstructive jaundice and of hemolytic jaundice. Van den Bergh believed that they were essentially different according to his experience with the Ehrlich diazo reaction. This reaction is direct in obstructive jaundice and indirect in hemolytic jaundice; in other words, the bilirubin in the blood before it reaches the liver will not give the typical color on the addition of the reagent but requires the addition of alcohol before this color is produced (indirect reaction). If on the other hand the same bilirubin after it has passed through the hepatic cell and is reabsorbed into the blood gives a direct reaction, the typical color appears as soon as the reagent is added. The pigment is apparently altered in its passage through the hepatic cell.

Magath and Sheard in their experiments showed that the spectral analysis of serum obtained from essentially normal persons and of that from persons with jaundice from various causes are alike. While it is evident from the van den Bergh reaction that the bilirubins vary, possibly in their physical states, the substance is essentially the same whether from an obstruction or a hemolytic cause, and the common source is the erythrocytes. Hemorrhage in the body is associated with an increase in serum bilirubin. Magath and Sheard showed that as far as spectrophotometric determination is concerned the bilirubin of normal persons and of those suffering from malaria, pernicious anemia, hemolytic icterus, or jaundice due to common duct obstruction are the same.

Any process resulting in too rapid destruction of blood or too slow excretion of bile results in retention of bilirubin. In hemolytic jaundice the erythrocytes are more fragile than normal and hence they are more readily broken down, which explains the jaundice. In malaria the increased amount of bilirubin in the blood is due to the rapid mechanical rupture of the erythrocytes.

By means of the spectrophotometer it is possible not only to identify bilirubin as such but also to measure it in smaller quantities than has previously been possible by any calorimetric method.

Another phase of the absorption of bilirubin and its excretion by the liver has been brought out by Mann[5] in states of biliary duct obstruction. Following the occlusion in the common duct the pressure within the ducts is increased. When this pressure reaches a certain level the hepatic cell becomes impervious to bilirubin so that bile pigment is neither excreted into the bile capillaries nor is it absorbed from the blood by the hepatic cell. When this condition occurs the jaundice is similar to that following complete removal of the liver; the pigment formed in the bone marrow is held in the circulatory blood, some is absorbed by the tissues, and some is excreted in the urine.

If this be true we must alter the explanation of the direct van den Bergh reaction in obstructive jaundice. The direct van den Bergh reaction in this type of jaundice is supposedly due to changes in the bilirubin as it passes through the hepatic cell. If the hepatic cell under such circumstances is unable to absorb bilirubin from

the blood, the change cannot take place in this way.

The difference between the bilirubin giving a direct, and that giving an indirect reaction, is that in the latter the bilirubin is combined with the serum protein or lipoids so that it does not react with the van den Bergh reagent until this linkage has been broken by the addition of alcohol. The direct reaction of obstructive jaundice may be due to retention in the blood of a substance which destroys the union of the bilirubin with the serum and allows it to react in a direct manner. This inability of the hepatic cell to absorb bilirubin in obstructive jaundice has a bearing on the phenoltetrachlorphthalein test of liver function and cholecystography in this condition.

Excessive pigment in the blood may arise from one of two causes: (1) Production of bilirubin in the marrow and spleen may exceed the ability of the liver to remove it from the blood, and the pigment accumulates in the serum. In this case the van den Bergh reaction is indirect. (2) Because of obstruction in the extrahepatic ducts or of disease of the hepatic cell itself either the bile is dammed back and escapes into the blood or, as was previously mentioned, the hepatic cell no longer is able to remove the pigment from the blood. Here the van den Bergh reaction is direct. In either case there occurs a time when the bilirubin in the blood is present in an amount exceeding the normal yet not enough to discolor the skin, sclera, or urine. As this accumulation increases a point is reached at which these phenomena appear. It is evident, therefore, that hyperbilirubinemia may occur without manifest jaundice, a state which is known as latent icterus. The demonstration of latent icterus furnishes a means of differentiating diseases which in some respects have certain factors in common. An increase of bilirubin in the blood in the presence of anemia would suggest a hemolytic rather than a secondary type of anemia especially that associated with carcinoma. In cases of hemolytic jaundice

and pernicious anemia, changes in the serum bilirubin serve to indicate changes in the severity of the hemolytic process.

An increase of serum bilirubin associated with an indirect diazo reaction is characteristic of icterus of hemolytic origin and is diagnostically valuable.

The icterus index (a test for retention of bilirubin) is dependent on the comparison of the color of the serum with a standard potassium bichromate solution. This test, however, is not devoid of error, as other substances especially the vegetable pigment, carotin, may impart a yellowish color to the serum. The van den Bergh method of measuring the quantity of pigment in the circulatory blood is not only more accurate but also distinguishes qualitatively the type of bilirubin present.

In obstructive jaundice the bilirubin curve is of appreciable help to the surgeon; an upward curve indicates increased attendant danger of hemorrhage, when operation should be avoided, and on a downward curve the surgeon may choose the most advantageous time for operation.

The estimated pigment in the blood is a more accurate criterion of the progress of jaundice than the degree of staining of the skin and sclera, as the pigment content of the plasma returns to normal sooner than the color disappears from the tissues.

During acute attacks of cholecystitis latent icterus is frequently present, and may be of diagnostic importance. In chronic cholecystitis it is normal. An elevation of the bilirubin level in the blood can be expected whenever hemorrhage takes place in an organ or cavity or in infarction. It may be of aid in determining definitely the presence of a ruptured ectopic pregnancy or hemorrhage from a ruptured viscus.

LIMITATIONS OF THE DYE TEST

The endeavor to evolve a test which would be indicative of the function of the liver as a whole seems futile since the hepatic functions are many and varied and more or less independent of one another.

The disturbance or cessation of one function is consistent with normalcy in the other. Too, the large reserve of the organ is a hindrance to a study of the details of hepatic deficiency. Mann has shown that it is possible to remove at one time without any deleterious effect on the animal as much as two-thirds of the organ.

Tests of liver function with pigment (phenoltetrachlorphthalein, bromsulphthalein) are associated with significant error since excretion of the pigment takes place with the secretion of the bile and for this reason is dependent on production and secretion of bile. We are thus far not in a position to decide in each type of manifest icterus to what extent the change of bile flow as such or the disturbance of function of the liver cells affect the retardation of excretion. This has definite significance for the test of hepatic function especially for the clinician for he must forego in this manner any kind of differential diagnosis regarding the individual cases of icterus. It may be seen, therefore, that the retention of dye is always to be found in the first place and in the highest degree in pronounced icterus of whatever nature it may be. Hence the dye test in cases of definite icterus expresses really no more than the icterus itself; in latent icterus, in beginning as well as in subsiding catarrhal icterus, and corresponding cholelithiasis, the dye test expresses no more than the latent icterus itself.

The test in the majority of instances can establish only what clinical examination teaches, corroborated by the diazo reaction (van den Bergh test) in the blood, and other tests which are to be mentioned. There is no further clue for the differential diagnosis and often not even for the existence of hepatic changes. If for instance there is prolonged dye retention in the serum in a nonicteric case with or without ascites with definite pathologic but diagnostically obscure liver findings there still is no clue from the dye test whether for instance it is a case of cirrhosis, carcinoma, obstruction in the liver, or fatty liver. It is

for this reason that there is expression in the literature of only the expectation that these tests will in the future explain a very few cases, especially those in which damage is due to lues and latent salvarsan injury. Another exception may be mentioned; after complete disappearance of jaundice and the return of the serum bilirubin level to normal there frequently is a persistent slight degree of dye retention that apparently indicates the degree of residual hepatic disturbance in consequence of the jaundice. Metastasis in the liver from known carcinoma elsewhere, without jaundice is sometimes revealed by dye retention. When this occurs it is significant but frequently metastasis occurs with normal dye excretion.

On the basis of physical examination and with the aid of other functional tests the clinician may with a high degree of certainty diagnose hepatic disease and functional disturbance as such; he is especially interested in progress in the field of differential diagnostic methods. But the dye tests, however much they deserve theoretic interest and however much they may represent a practical aid in cholecystography, have added little as regards a liver function test and especially differential diagnosis.

GALACTOSE TEST

Two tests which are being used quite extensively in Europe, especially in Vienna, seem to be of aid in differentiating the types of jaundice: the galactose test[2] and Ehrlich's aldehyde reaction. For the galactose test 40 gm. of pure galactose is given in the morning on an empty stomach. The bladder is emptied preceding the ingestion of the sugar. The urine is collected every hour for four hours or until a specimen contains no sugar. The entire amount of urine is then examined quantitatively for sugar according to the method for the quantitative estimation of glucose in urine. The excretion after 40 gm. of galactose is as follows: 1 gm. and less,

normal; from 2 to 3 gm., doubtful; 3 gm. and more, positive.

According to Bauer[2] the test is negative in all cases of mechanical icterus whether it is manifest or latent. It is positive only when the icterus is the expression, or secondary symptom, of true disturbance of the function of the hepatic cell as for instance in catarrhal icterus, cirrhosis of the liver (both types), or subacute and acute atrophy of the liver. In this manner he gained the knowledge that the hepatic cell becomes severely damaged by transitory mechanical icterus only in the rarest cases and that a final injury of the hepatic cells occurs only rarely.

In the galactose test there are not only possibilities for differential diagnosis but also direct knowledge of the pathology of icterus. In the non-icteric cases, in those already mentioned in which latent icterus comes into consideration, the galactose test is likewise independent of these relations. It shows here only the functional disturbance of the hepatic cell itself. Thus for instance Bauer finds the galactose test positive quite regularly in cases of hepatic cirrhosis especially in the pre-ascitic stage, regardless of whether the patient has latent icterus, manifest icterus, or no icterus. In localized disease of the liver as gumma, or benign and malignant tumor, the galactose test remains negative or at least normal because here the hepatic function is scarcely disturbed. In cases of acute and subacute liver atrophy and salvarsan icterus there are also positive values which are parallel with the condition or with the variation in its course.

In cases of ascitic cirrhosis the amount of the total excretion suffers from decreased resorption and delayed oliguric excretion. Here the duration of the sugar excretion which may last for from four to twenty-four hours, as well as the high sugar content of the small amount of urine are in themselves pathognomonic. In secondary lues, disturbances of hepatic function are demonstrable by the galactose test and for this reason this test should be used in doubtful cases preceding salvarsan treatment.[3]

EHRLICH'S ALDEHYD REACTION

Bile pigment in the intestinal tract is changed to urobilin and urobilinogen and this is excreted in the feces. Some, however, is reabsorbed into the portal circulation and taken to the liver to be changed and excreted in the bile. As long as the liver is normal little if any escapes into the general circulation to appear in the urine, although traces sometimes appear in the urine of normal persons.

If there is disturbance in the liver, urobilin and urobilinogen escape into the hepatic veins and so into the general circulation and appear in the urine in large amounts as detected by Ehrlich's aldehyd reaction. The qualitative test consists of adding 1 c.c. of Ehrlich's aldehyd reagent (2 gm. paradimethylaminobenzaldehyd dissolved in 100 c.c. of a 20-per cent solution of hydrochloric acid) to 4 or 5 c.c. of urine. If urobilin is present a red color appears immediately. The dilution in which urobilin is present can be estimated spectroscopically. The amount and not simply the fact that the reaction is positive is most important. This aldehyd reaction serves a purpose not so much as regards hepatic disease in general but as regards the judgment of icterus in particular. The aldehyd curves of urine, especially in comparison with the bilirubin curves are according to the Viennese school almost pathognomonic for the individual forms of icterus.

The fact that urobilin is formed from bile pigment in the intestinal tract is valuable in differentiating mechanical obstructive jaundice and hepatogenic jaundice. In obstructive jaundice with complete block such as occurs in carcinoma of the head of the pancreas, no bile reaches the intestine; consequently no urobilin can be formed and the aldehyd reaction in the urine will be negative. In jaundice due to parenchymatous hepatic disease such as catarrhal jaundice or the cirrhoses of the liver, bile is never completely absent from the intestine and urobilin appears in the urine in large amounts.

In a given hepatic disease, as is almost

always true in cases of icterus, the aldehyd reaction is directly opposed to the degree of icterus. The first consequence of disturbance in the liver is a positive aldehyd reaction. In every type of jaundice whatever the cause the aldehyd reaction will at first be positive. It will be positive before the onset of jaundice; as the jaundice increases the aldehyd reaction decreases and finally becomes negative in the presence of total obstruction of bile. On the day the patient has bile in the urine and a negative aldehyd reaction the jaundice and obstruction are complete no bile escaping into the bowel. A negative aldehyd reaction in a person long jaundiced would suggest malignant or total obstruction of the common duct. If after from four to five weeks the reaction became positive the malignant condition would be ruled out.

In cases of cirrhosis of the liver, and catarrhal jaundice, the aldehyd reaction is positive. Metastatic carcinoma in the liver according to Bauer will give a positive aldehyd reaction. This would be of inestimable value to the surgeon in deciding as to the operability in case of certain malignant conditions. If then in abdominal carcinoma the aldehyd reaction is negative metastasis of the liver would be ruled out.

Lues because of a toxic influence weakens the liver; in other words, it predisposes the liver to other affections. If in a person with lues, catarrhal jaundice develops it may last for months. If a luetic patient (without jaundice) has a marked aldehyd reaction and positive galactose test, the hepatic condition should be improved before salvarsan is given; this will reduce the danger of producing atrophy of the liver.

The aldehyd reaction is positive in malaria, and it is marked in the presence of hemorrhage anywhere in the body. The same is true of infarction. In case of infarction of the lung there may be no hemoptysis; however, a positive aldehyd reaction can usually be obtained. The aldehyd curve in case of obstruction of the common duct by stone seldom shows a permanently negative aldehyd reaction; in daily multiple examinations one repeatedly finds a flare-up of the reaction; the obstruction by a stone is rarely continuously complete. Obstructive jaundice by stone, in the absence of cholangeitis, may persist several months without necessarily damaging the liver. At times it is not complete and a little bile escapes so that the strain on the liver is not as marked as it would be were the obstruction always complete and constant. The liver soon recovers when the obstruction is relieved.

The aldehyd curve of catarrhal jaundice is an interesting one. Early in the disease the test is definitely positive; after two or three weeks it may be completely negative for a short time, and then rise rapidly while the bile pigment in the urine decreases; it becomes more marked when the urine is free from bile pigment and after the jaundice subsides the curve may vary and gradually become negative. This curve shows clearly the course of the jaundice, and shows that in catarrhal icterus there is a stage of complete obstruction of bile. For some weeks after the jaundice of catarrhal icterus has subsided the diazo reaction and galactose test may still be positive. These findings demonstrate that catarrhal jaundice is not as harmless as is believed.

Bauer[1] has shown that histologic examination of the liver in catarrhal jaundice gives findings which indicate quite specifically that at the peak of this disease there are principally the same changes as in acute atrophy of the liver. Since the alimentary galactosuria which remains negative in mechanical icterus and circumscribed hepatic disease, is positive in precisely such diseases as acute and subacute liver atrophy, phosphorous liver, hepatic cirrhosis, and catarrhal icterus, Bauer has, because of the similarity of these functional findings, suggested an anatomic resemblance in these latter processes.

FORMS OF HEPATIC JAUNDICE

The old term, catarrhal jaundice, is somewhat of a misnomer. The condition is not caused by a catarrhal condition of the

ducts nor duodenitis but is a definite affecton of the hepatic cell itself. European physicians chose rather to call it simple jaundice or hepatosis. Catarrhal jaundice may develop into hepatic cirrhosis. Since the anatomic picture of catarrhal icterus resembles that of acute liver atrophy it may lead to subacute liver atrophy.

The interesting picture of subacute liver atrophy has been known since 1919. Everyone saw such clinical pictures before that time but was unable to interpret them. Some fever, varying icterus, pain in abdomen, sometimes ascites, a varying tedious course are the principal characteristics of the disease usually diagnosed as catarrhal icterus, cholangeitis, cholelithiasis or inflammation of the portal vein. The disease is not as rare as one would expect. I recently had a case in which the presence of subacute atrophy of the liver was suspected and was confirmed at necropsy.

In subacute atrophy of the liver, the liver and spleen may remain enlarged. The liver is nodular and the condition may be mistaken for carcinoma or lues. Such patients may have recurrence of symptoms off and on, sometimes after a year's interval. I have observed one such case.

In this disease group may be mentioned also cases of so-called luetic icterus and salvarsan icterus. As regards luetic icterus Bauer has assumed on the basis of the galactose findings that, like catarrhal jaundice, it is a toxic parenchymatous icterus. Salvarsan jaundice is apparently produced on the one hand by luetic toxins, on the other hand by salvarsan damage to the liver. Salvarsan icterus especially may show the clinical picture of subacute liver atrophy or change into this disease. If a patient has catarrhal jaundice which does not disappear in the usual length of time, lues should be suspected.

To prevent salvarsan icterus in luetic patients who show a weakened liver by positive aldehyd and galactose tests they should be filled with sugar, as the liver requires sugar in the detoxification of many substances.

The difficult question of hepatic cirrhosis, especially the classification, is of special interest here from the standpoint of icterus. In portal or atrophic cirrhosis significant icterus may be observed which may be so marked at times that it suggests carcinomatous icterus. This may be true as long as the liver is still large. In portal cirrhosis a preceding stage with large liver can be observed.

Cases of so-called Hanot's cirrhosis are extremely rare. On the other hand there are forms of hepatic cirrhosis in which splenomegaly and jaundice are the chief symptoms but instead of a large smooth liver there is a granular liver. Improvement or cure may follow splenectomy in these cases.

Non-obstructive biliary cirrhosis is rarely met with. The type of the disease most frequently seen is that due to obstruction and infection of the ducts.

European physicians believe that biliary cirrhosis from retention of bile in obstruction of the common duct is rare; their evidence is quite convincing. They have the opportunity of observing their cases over a long period of time. The material is abundant and necropsies are done routinely.

Judd and Counseller believe that in obstruction of the common duct biliary cirrhosis may or may not occur. This depends on the type of obstruction and the presence or absence of infection. Stones in the common duct and in the gallbladder are frequently associated with infection in the wall of the gallbladder and of the ducts. The obstruction from stone is rarely constantly complete; intermittently bile escapes into the intestine, relieves the pressure and allows the ducts and liver to recover somewhat from the effects of biliary stasis. The associated chronic cholangeitis ascends to the finest bile ducts and hepatic acini producing the perilobular type of fibrosis and proliferation of ducts, typical of obstructive biliary cirrhosis. Because in this type of occlusion the obstruction is intermittent, according to these authors, dilatation of the biliary

tree is not excessive which accounts for the absence of hydrohepatosis. They believe that stricture of the common duct with resultant obstruction which is seen mainly following operation on the biliary tract, is not due to injury inflicted at the time of operation but to obliterative cholangeitis. Fibrosis of the ducts and portal spaces is marked producing a severe grade of obstructive biliary cirrhosis.

Malignant obstruction which is almost always due to carcinoma of the head of the pancreas is complete resulting in a marked degree of dilatation of the biliary tree or hydrohepatosis. Here infection is absent or is only a terminal event, and biliary cirrhosis rarely occurs. There must be infection in addition to obstruction to cause such cirrhosis.

The European investigators may be correct in their observations that biliary cirrhosis rarely occurs in obstruction of the common duct, but this is probably only when there is absence of infection.

Judd and Counseller state that Courvoisier's law is entirely applicable to the whole biliary system as it is to the gallbladder and common duct, and that the condition of the gallbladder may be taken as an index of the condition of the biliary system in general. If it is small, fibrotic and contracted on stones, the ducts themselves are probably not particularly dilated following obstruction of the common duct although it may be surmised that they are the seat of more or less marked chronic cholangeitis. If the gallbladder is dilated, thin-walled, and free from stones, as occurs in carcinomatous obstruction at the head of the pancreas, the extrahepatic biliary tree is also probably tremendously dilated but free from infection.

Another disputed question is that of Banti's disease, which is thought to begin with anemia and splenomegaly (first stage), later leading to cirrhosis of the liver (second stage) and ascites (third stage). Characteristic cases of Banti's disease are rarely seen in this country or in Europe with the exception of those countries bordering on the Mediterranean Sea. It is more likely that we must assume that some cases of hemolytic jaundice or yellow cirrhosis as well as cases of thrombosis of the splenic and portal veins or occasional splenic tuberculosis or neoplasm are diagnosed as Banti's disease.

The usefulness of cholecystography in the diagnosis of pathologic conditions of the gallbladder needs no further mention here. It must be remembered, however, that the dye is taken up by the hepatic cell and excreted in the bile; consequently in the presence of jaundice with the hepatic cell incapacitated the excretion of the dye can no longer occur. If jaundice then is present, no information concerning the gallbladder can be obtained by cholecystography.

So, after all, our knowledge of the liver, its functions in the normal state and its varied reactions to disease is not as meager as that of a few years ago. Further investigation will undoubtedly substantiate present views and conceptions that the liver plays one of the most prominent and conspicuous rôles in the metabolism of the body.

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ACUTE CELLULITIS OF THE HYPOPHARYNX AND NECK WITH EXTENSION TO THE MEDIASTINUM

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DETROIT

WE are here presenting the case of a young married woman, thirty years of age, admitted on the general surgical service March 15, 1927. Her past history gave no evidence of sore throats or frequent colds, and her family history was unessential.

Her present illness dates from March 11. Four days previous to admission the patient had had a slight sore throat; twenty-four hours later she noticed extreme difficulty in swallowing, and even talking caused considerable pain. There was swelling and tenderness in the right side of the neck. On the following two days she was unable to take anything by mouth on account of the pain in the right side of the neck. She had used iodine over the neck in the region of swelling with no relief, and also an argyrol spray and silver nitrate applications to the throat. The patient had noted some enlargement of the neck for the past several years, but no symptoms of thyroid disease. There was a history of pregnancy of five months' duration but the patient's general health had been very good until the onset of the present illness.

On physical examination, at admission, the patient was acutely ill. The temperature was 100.2°, the pulse 118. She was unable to talk above a whisper. There was rather marked swelling of the right side of the neck extending from below the jaw to the right clavicle. This was extremely tender but no induration and no evidence of fluctuation were made out. All of the cervical glands of the right side were slightly enlarged. We were unable to palpate the right lobe of the thyroid on account of the acute tenderness. The left lobe of the thyroid was moderately enlarged. There was definite exophthalmos. The pharynx was rather injected, the tonsils small, cryptic and injected. The chest was clear to percussion and auscultation and examination of the heart showed a slight enlargement with a systolic murmur which was transmitted to the axilla.

Examination of the abdomen showed a symmetrical midline tumor, which extended to within two finger breadths of the umbilicus. There was no abdominal tenderness or rigidity.

Dr. Garretson saw the patient and found considerable edema of the epiglottis and was suspicious of an abscess on the right side. There was marked tenderness of the larynx. Dr. Garretson advised steam inhalations and ice compresses to the neck, and further observation of the patient. Fluids were forced by proctoclysis, hypodermoclysis and intravenous injections.

Laboratory reports on admission showed w.b.c., 52,000, polymorphonuclears, 97 per cent. Culture of the throat showed hemolytic streptococcus and smears taken from the throat showed numerous chains of streptococci, with a few fusiform bacilli and spirilla. A blood culture taken that day was negative, and the Wassermann was also negative. The following day, March 16, 1927, the patient's temperature was 103, her pulse 130 and her condition apparently very much worse.

She was taken to the operating room,

and under local anesthesia Dr. Garretson incised a small abscess at the base of the epiglottis. Following this the patient was much more comfortable and was able to take some fluids by mouth. Tenderness and swelling of the right side of the neck, however, had increased, with some swelling of the left side as well. No fluctuation, however, was noted and the mass showed little induration.

Towards evening her condition began to grow worse, with increasing respiratory difficulty and rising temperature. She was taken to the operating room and Dr. McGraw made an incision along the anterior border of the right sternomastoid muscle down to the thyroid gland, with the hope of finding pus. She took the anesthetic very poorly and because of the respiratory difficulty a tracheotomy had to be done. A small amount of purulent bloody serum was encountered under the surface of the sternothyroid muscle and about the thyroid gland. Drains were placed in the wound. Cultures from this wound revealed a hemolytic streptococcus. The patient spent a somewhat better night, but on the following day her temperature remained up and her pulse was around 140 or 150 per minute. She was complaining of considerable substernal pain and was very tender on pressure over the sternum. Many fine moist râles were heard over the mediastinal region. The chest was otherwise clear to percussion and auscultation. The fluid intake was kept up by means of hypodermoclysis and intravenous therapy.

A blood culture was taken three days after admission and was reported positive for hemolytic streptococcus. On the morning of the third day the patient began to have some pelvic pain with a slight discharge of blood. About three o'clock in the afternoon the patient's pain increased in severity, and on examination the head of a fetus was found in the vagina; shortly afterward she expelled a male fetus of 26 cm. in length. The placenta was expelled intact ten minutes later and no hemorrhage followed. During the abortion the

pulse was as high as 170 per minute and was extremely feeble. Following this she was transfused with 650 c.c. of citrated blood with no adverse reaction. Her condition continued to grow worse, the temperature remaining high and pulse extremely rapid, but the patient had very little respiratory difficulty with the tracheotomy tube. The respirations were, however, somewhat irregular and the patient distinctly stuporous, but she could be aroused easily and could make known her wants.

The following day she was again transfused and was given 20 c.c. of 1 per cent aqueous mercurochrome solution intravenously. There was no reaction from this and no changes in the pulse or temperature were noted. She was also given 10 c.c. of a special concentrated polyvalent anti-streptococcus serum which was sent from a local pharmaceutical company. She continued, however, to grow worse and became very cyanotic, with a very feeble pulse; considerable abdominal distension and tenderness over the lower abdomen developed, and she died at four in the morning of March 20, five days after admission.

Diagnoses were made of: septicemia, hemolytic streptococcus; acute mediastinitis; cellulitis of the neck; and abscess of the larynx.

DISCUSSION

Dr. Garretson: I saw this patient the day after she was admitted to the hospital. The case impressed me, as it did Dr. McGraw and the rest of the men who saw her, as a very serious one. Laryngeal examination showed an abscess of the epiglottis and intense edema of the pyriform sinus and posterior wall of the pharynx. There was no definite bulging of the pharynx, just a brawny induration. The next morning the edema and infiltration were even more marked and we drained the abscess of the epiglottis and made an incision laterally, but did not think there was any definite localization in the region of the hypopharynx. I saw the autopsy and was impressed with the retroesophageal inflammation at the base of the hypopharynx.

In drainage of retropharyngeal abscesses in the region of the hypopharynx it is much better, if there is no diffuse cellulitis of the neck, to make an incision along the anterior border of the sternomastoid, then to retract it posteriorly and separate the visceral from the vascular fascial sheath. This permits entry into the hypopharyngeal region. There are no important structures passing between the visceral and the vascular sheath in the region from the level of the greater cornu of the hyoid bone above to the level of the cricoid cartilage below. In this so-called "neutral zone," the two sheaths can be separated; externally, the internal carotid and the common carotid and internal jugular vein; internally, the esophagus, pharynx and larynx. Median incision over the trachea will not drain this region.

I have drained several abscesses in this region by this method, to avoid upper respiratory tract infection and also cellulitis of the neck. In this case, even though we assumed that there was a retropharyngeal abscess, we did not feel that it could be drained because of diffuse cellulitis throughout all planes of the neck. It is much better to use local anesthesia, as very frequently in general anesthesia the patient will develop edema of the larynx and tracheotomy will have to be resorted to.

Some years ago I had a case in Edinburgh with retropharyngeal abscess in the hypopharynx. The patient could not swallow and also developed intense edema of the larynx. At my suggestion, the abscess was drained by the method just described and the patient could swallow fluids almost immediately afterward, and made an uneventful recovery. If we had had to resort to tracheotomy, pneumonia in all probability would have developed.

DR. McGRAW: I can recall perhaps a half-dozen cases of severe infections in the cervical region. Of these I remember three which proved to be deep cervical abscesses with a considerable accumulation of pus. Two of them were acute with all the evidence of an intense inflammatory reaction; the third was a rather chronic affair with edema only and a certain amount of brawny induration to suggest an underlying abscess. Two other cases that I recall seeing through their course in the hospital were more of the type of the case that is being presented today; that is, an acute fulminating perilaryngeal and periesophageal infection with a tendency to spread down the fascial planes of the neck, causing a mediastinitis. The second

of these cases came into St. Luke's Hospital, New York, with symptoms somewhat like the present patient's, but not as acute. The edema and tenderness, and swelling of the tissues of the neck tended to be symmetrical and a little lower than one would expect for a true Ludwig's angina. This man was seen three or four times by Dr. Downes, who refused to make an incision in the infected area. The man was placed in a steam tent, watched very carefully, and in the course of four or five days began to improve; eventually he made a good recovery without our ever being able to make out any localized focus of infection. The other case was of a woman some ten years older than the present patient, who was brought into the same hospital one evening, with the same history of painful swelling of the tissues of the neck, following a sore throat of rapid onset. She presented the same picture as our patient of today, a rather diffuse edema and tenderness of the neck, a little more tender on one side than on the other. This case was opened up under local anesthesia, and the incision carried down beneath the sternothyroid muscle and also higher up in the neck to a point beneath the mylohyoid muscle and into the capsule of the submaxillary gland. In her case there was no pus found at all, simply a large amount of thin serous exudate. The organism was the same, a hemolytic streptococcus. Tracheotomy had to be done the following morning, and she died within forty-eight hours after entering the hospital.

DR. HARTMAN's report of the postmortem examination: The patient was a rather slight woman, 160 cm. in length. The skin was rather firm except for the marked rigidity of the back, chest, face and neck. The striking thing was the cervical incision in the neck, extending from the level of the larynx to the suprasternal notch, through which the thyroid gland presented. The base of this wound was covered by a thick yellow exudate and the thyroid was surrounded by similar exudate. The chest was rather long and narrow, but symmetrical. On opening the body, thick yellow pus spurted from the abdominal incision. The peritoneal surface was rough and covered by fibrin. The pelvis and flanks were filled with this same type of rather thick yellow exudate, a surprising type of extravasation for a streptococcic infection. The loops of bowel and the other organs were all surrounded by this exudate. The diaphragm was quite low, extending to the 5th rib on the

right and to the 5th interspace on the left. On opening the thorax, the left side contained 1000 c.c. of turbid fluid in which flakes of fibrin floated. The right side showed 1500 c.c. of the same type of fluid—in fact, the fluid flowed from both cavities as soon as the incision was made.

There were no fibrous adhesions on either side, but the lower lobe of each lung was completely collapsed against the diaphragm. The pericardium contained about 300 c.c. of fluid, but the pericardial surfaces were smooth. The right side of the heart was markedly dilated, especially the ventricle, and the tricuspid ring measured 12 cm. contracted, with the mitral measuring 8 cm., showing the disproportion between the two sides. The valves were intact but the heart muscle was gray, even necrotic in places. The largest area of necrosis was 1 cm. in diameter, and was in the wall of the left ventricle. Surrounding the necrotic area there was considerable congestion. The mediastinum showed small abscesses in the upper portion and this same type of thick yellow pus exuded when the sternum was separated from the mediastinal tissue. The infiltration extended down and around the great vessels and over the arch of the aorta. The neck organs and arch of the aorta were removed en masse, and when the pharynx was severed above the larynx there was a good deal of exudate infiltrating the fascial planes; this was seen to extend along the fascial planes covering the vertebrae down into the mediastinum, entirely surrounding the esophagus and trachea down to the bifurcation of the trachea. The upper fascial planes were not so extensively infiltrated and there were no abscesses nor any infection of the thyroid gland

proper. On section it was grayish red in color and semitranslucent.

Returning to the chest, the lymph glands were all enlarged but none showed suppuration. The lungs were about the usual size, the left weighing 400 and the right 500 gms. The upper lobes were both air-containing and edematous, but the lower lobe on both sides and part of the middle lobe on the right were entirely collapsed. Bits of this tissue dropped in water sank at once.

The abdominal cavity showed little except the extensive fibrino-purulent peritonitis. The spleen and liver were of usual size. The liver and kidney on section were gray and granular, having the grayish granular cooked appearance of parenchymatous degeneration. The uterus was considerably enlarged, measuring 20 by 15 by 12 cm., and its walls were 2 cm. in thickness. The lining endometrium was gray and necrotic, with considerable hemorrhage in the walls. In each broad ligament there was thickening and adhesions, but not of a recent process. Each ovary contained small cysts and this cyst fluid was purulent. The tubes were patent, but contained no exudate.

Diagnoses were made of: history of streptococcus sore throat, retropharyngeal abscess, hemolytic streptococcus septicemia, hemolytic streptococcus peritonitis, cellulitis of neck, mediastinitis. Postoperative wound for tracheotomy and drainage of cervical cellulitis; acute fibrino-purulent pleurisy, bilateral; partial atelectasis, lower lobe of both lungs; diffuse necrotic myocarditis. Postpartum uterus with acute endometritis and metritis; chronic salpingo-oophoritis, bilateral, with acute infection of ovarian cysts; chronic cholecystitis, perihepatitis and perisplenitis.

LYMPHOSARCOMA: PRIMARY IN THE INGUINAL GLANDS

A. B. McGraw, M.D.

Henry Ford Hospital

DETROIT

THE patient to be studied is a married white man, aged fifty-seven, a retired farmer by trade. He first entered the diagnostic clinic of the Henry Ford Hospital on February 21, 1927, with the chief and only complaint of a swelling in the right groin of some three years' duration. Venereal infection was denied. There was no family history of neoplasm or tuberculosis. His general health throughout the course since his entrance complaint had been good.

Three years ago he noticed the appearance of a painless non-tender lump beneath the skin of the right groin, a little smaller than a walnut in size. This grew gradually larger until it reached a size of three times its original dimensions, but it was never tender, nor was the overlying skin swollen or red. There were no associated systemic symptoms and no medical advice was sought or treatment instituted. After growing in this way over a period of two years, the size of the lump began last summer to recede until it once more was no larger than a walnut. Beginning this fall, however, increase in size again commenced, progressed more rapidly, and recently produced slight local discomfort. The swollen mass reached somewhat larger dimensions than its previous greatest size, but again no effort was made either towards diagnosis or therapy.

Physically the patient was a stockily built, rather sallow middle-aged man, 5 ft. 1½ in. in height, 152 lbs. in weight, slightly obese and of fair muscular development. Temperature, pulse and respiration were normal, blood pressure 140/90. His reflexes were o.k. General examination of heart, lungs, abdomen, extremities, genitalia and rectum revealed nothing unusual, except as will presently be noted. Special examination of eyes, ears, nose and throat showed moderate ametropia and deflection of nasal septum, with spur formation.

In the right inguinal region there could be seen an elevation of the skin, rather irregular in contour, indistinct in outline, and showing over a small area perhaps 2 by 3 cm. a slight dusky redness of the skin. Palpation of this swelling did not cause pain nor was there any sensation of temperature elevation, pulsation or thrill detected. Palpation further confirmed the irregularity and indistinctness of outline. It was uniformly firm and toughly elastic in consistency. It did not give the impression of an intra-abdominal mass, but rather of lying in the abdominal wall. The mass was immovable over the deeper tissues, and apparently fixed to the skin also. The slightly reddened area of skin, before referred to, was not fluctuant. On investigation in the left inguinal, both femoral, both cervical and both axillary regions, there was no enlargement of lymph glands detected, discretely or in groups.

Laboratory studies done on the patient were as follows: Hemoglobin 15.3 grams, white blood count 5600 to 6400; differential, polymorphnuclears 66, eosinophiles 4, small mononuclears 17, large mononuclears 13 per cent. Urine on examination showed 1 plus leucocytes and epithelial cells. Blood Wassermann test was negative.

Roentgen-ray photographs of the chest showed no unusual findings other than moderate relative elevation of the right dome of the diaphragm.

In considering what structure or structures might have given rise to the above mentioned swelling, it was felt that hernia could at once be ruled out on account of the chronicity of the process and its lack of subjective symptoms; aneurysm by the lack of impulse or thrill; and an intra-abdominal abscess, tumor or

psoas abscess by the fact that the mass so clearly seemed to lie in the abdominal wall only. It seemed quite clear that the structures primarily involved in the mass were the right inguinal group of lymph glands, involved either in a chronic infectious or malignant process, and if malignant, either primary or metastatic. Infectious processes to be considered were tuberculosis, or possibly a granuloma secondary to some chronic infectious focus in the genitalia or rectum, evidence of which was wholly lacking.

Primary neoplasms to be considered were benign lymphoma, lymphosarcoma, pseudoleukemia, Hodgkin's disease, and the large round cell lymphosarcoma of recticular origin. Metastatic neoplasms to be considered, in the absence of other demonstrable glandular enlargement, were carcinoma and sarcoma, more likely the round cell sarcoma and less likely the spindle celled. The absence of a present chronic pyogenic infectious focus which these glands might drain, or the history of such a focus previously existing, seemed to weigh against such a cause for the tumor. Tuberculosis, primary or more probably metastatic, we felt could not definitely be ruled out, and in spite of absence of history, symptoms, or physical signs of tuberculosis elsewhere, was consistent with the clinical development of the process, its painlessness and its remission and subsequent exacerbation.

In the matter of neoplasms, the failure to find a primary source would not necessarily rule out metastatic sarcoma or carcinoma, but the chronicity and the isolation of the mass seemed to do so. The blood picture ruled out a myxoma or lymphoma of leukemic origin. Hodgkin's disease, pseudoleukemia, lymphosarcoma, and benign lymphoma remained, and of these Hodgkin's seemed the most likely, because it could better be reconciled to the chronic nature of the mass and its regression and recurrence than any of the other three. The chronicity and isolation of the tumor were the hardest facts to

explain on a neoplastic basis, and finally led us to the erroneous working diagnosis of tuberculosis.

An operation was performed on March 1, 1927, under ethylene oxygen anesthesia, through an incision similar in length but a little lower than that of an inguinal hernia operation. It revealed marked edema and induration of the skin and subcutaneous tissue down to the deep layer of the superficial fascia. Beneath this layer of fascia in the region normally occupied by the right chain of inguinal glands, there was a firm, elastic irregularly lobulated mass which could be separated fairly easily by blunt dissection. Carrying this blunt dissection around the edges of the mass, it was soon found that contrary to its relation to the superficial fascia, the mass was firmly attached in places to the aponeurotic fascia of the external oblique and rectus sheath, and definitely infiltrated these structures. This being the case, such of the mass as had been freed, altogether a piece about 4 by 6 by 6 cm. in size, was removed for frozen section, leaving behind what felt like about an equal amount of residual tissue, which even more definitely seemed to infiltrate its surroundings. In one place where the mass had surrounded what was apparently the superficial epigastric vein, this vein was torn across, revealing a cord of tissue lying free in the lumen of the vessel.

As frozen section showed the mass not only to be neoplasm, but from all appearances a definitely malignant one, further attempt to eradicate the tissue was abandoned in favor of roentgen-ray therapy.

The patient's wound has healed without infection or rise of temperature or pain, but with a small collection of bloody serum, due probably to the edematous wall of the wound failing to fall in and properly close the dead space left by the partial enucleation of the tumor mass. On the sixth day, the stitches were removed, and on the seventh day he was given the first of three deep roentgen-ray treatments. The other two were to follow during the week.

Follow-up note. Following roentgen-ray treatment the wound broke down in an area 3 cm. in length and there was drainage of serosanguineous fluid and bits of necrotic tissue for six weeks. Meanwhile the induration and remaining mass of tumor tissue improved and decreased steadily, and on follow-up visits at the end of six weeks and three months after operation the wound had healed and no tumor tissue can be felt, nor extension elsewhere demonstrated.

DR. HARTMAN's *pathological note:* I received this lobulated confluent mass of glands, which were not really encapsulated but surrounded by fibrous tissue. In making a section through this mass, the tissue was grayish pink in color, granular and semitranslucent, with glistening surface, an appearance which we always get in a malignant tumor. Sections from this mass showed that the architecture of the lymph glands was entirely destroyed and consisted of small round cell types, with many mitoses, as many as five or six in the low-power microscopic field. A pathological diagnosis of lymphosarcoma was made.

DR. McCLURE: Tumors in the inguinal region such as this one are extremely interesting, for the correct diagnosis is not easy and sometimes is correctly made only at the operating table. Dr. McGraw's statement that the diagnosis of hernia had been ruled out in this case calls to mind a case where the surgeon thought he had ruled out the possibility of hernia and performed a biopsy in a dispensary. His patient had an inguinal mass of equal size, which at times became a little larger and at times a little smaller. It was a hard, indurated irregular mass. The operator was suprprised when he cut into the tumor to find gas and fecal material appearing. The patient had had no cramps nor recent obstructing symptoms. The diagnosis in this case was Richter's hernia of long standing, with an inflammatory reaction around the nipple of bowel caught in the sac. There was very little or no narrowing of the lumen of the bowel, so there was no intestinal obstruction. This patient made a very satisfactory recovery, though a resection of the involved portion of the small intestine had to be done.

CYST OF THE PROSTATE GLAND WITH CONGENITAL ABSENCE OF THE RIGHT KIDNEY*

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NEW HAVEN, CONN.

THROUGH the courtesy of Dr. Clyde Leroy Deming, I am permitted to report the following case from the Department of Urology, Yale University and New Haven Hospital.

The patient is a male twenty-four years old, a clerk by occupation, who first reported to our clinic in April, 1923. At that time his chief complaint was frequency in urination. For the preceding four years he had had periodical attacks of frequency, each attack lasting for about ten to fourteen days. The onset of each attack was marked by frequency, with dysuria at the beginning and the end of urination. As the attack progressed, frequency and dysuria became more severe, urination occurring every ten to fifteen minutes. On the eighth to the tenth day the symptoms reached their height and by the tenth to the fourteenth day all symptoms would disappear. He never had hematuria, chills or fever or any pain in the back or flanks. Constipation and rectal tenesmus were present during the attacks and the bowels moved only with enemas.

Between attacks the patient had perfectly good health. He had been married two years. There were no abnormal sex symptoms.

In February, 1923, three months previous to admission, he had had an operation for repair of right indirect inguinal hernia and undescended testicle, which had been successful.

The physical examination revealed a well-developed young man of twenty-four, mentally alert and cooperative. The general physical examination was essentially nega-tive except for the recent scar of the right inguinal herniotomy wound.

Urological Examination. There was no deformity of the external genitalia; no urethral discharge. The right testis was slightly smaller than the left, and located in the upper half of the scrotum; the left testis and epididymis were normal.

Rectal Examination. The sphincter was of good tone. The region of the prostate was occupied, especially on the left side, by a rounded cystic mass which was about 4 cm. in diameter and about 3 cm. in width. It seemed to occupy the position of the left prostatic lobe and extended halfway across the right lobe. It extended upward, covering the base of the left seminal vesicle and continuing slightly across the midline to the base of the right seminal vesicle. The mass was adherent, especially along the outer surface. Palpation of the mass did not present any unusual tenderness, and felt like a thin-walled cystic body. The right and left seminal vesicles were normal in size and consistency. The right lobe of the prostate was about one-half its normal width. The notch between it and the mass was well made out. The mass did not impinge on the rectal lumen or upon the membranous urethra. The posterior wall of the bladder was smooth; the rectum was within normal limits.

Cystoscopic Examination. The cysto-scope was readily introduced and went almost straight into the bladder. Residual urine was 400 c.c. The bladder capacity was 500 c.c. A study of the bladder mucosa revealed no pathology. The most striking

feature within the bladder was the elevation of the trigone and right side of the bladder by an extravesical mass. The cystoscope could not be depressed, due to the mass in this region. The mucous membrane over the mass was normal, and the left ureteral orifice could be seen well up on the left side. It was large and could be observed functioning. Careful search for the right ureteral orifice was unsuccessful. The trigone, also, could not be followed all the way across the posterior wall of the bladder on account of the mass. On withdrawal of the cystoscope the posterior urethra was examined. The verumontanum was normal. The posterior urethra was somewhat reddened but no abnormal condition was seen. A large Garceau catheter was passed on the left side to the kidney pelvis.

Examination of bladder and ureteral specimens of urine were negative, both chemically and microscopically.

The phthalein test on the left side was 55 per cent in thirty minutes. The appearance time was two and one-half minutes. The patient voided about 30 c.c. three minutes after the Garceau catheter was removed and only a trace of phthalein was obtained from the bladder. We therefore concluded that in all probability the right kidney was absent. The routine laboratory data was normal.

Our impression at the time was: (1) cyst of the prostate gland; (2) congenital absence of right kidney; (3) cyst or diverticulum of the seminal vesicles.

Operation was advised, but the patient refused treatment and returned home.

In April, 1926, three years after his first visit, the patient returned with practically the same story seeking operative assistance.

He was operated upon, a perineal incision being made. The prostate was easily exposed. A seminal vesicle retractor was placed in the bladder through the urethra. On exposure of the prostate the normal gland and seminal vesicles were noted. After stripping off a rather heavy prostatic

capsule a normal prostatic tissue was encountered, which lay more on the left than the right. A portion of it was removed. Beneath this tissue was a cyst with many ramifications which occupied the right side of the bladder running upward for 608 cm. and across to the left side and forming an area about the size of a thumb. It was not unlike a pelvis of a kidney. The cyst was filled with half an ounce of bile-colored viscid fluid. It was lined with a very delicate membrane-like coat which was extremely adherent to the surrounding structures. There was no connection with the urethra or bladder. It was difficult to decide at operation whether it were a cyst of the prostate, a cyst of the seminal vesicle or a congenital malformation of a kidney.

A small wound was made in the posterior urethra for exploration. The cyst was drained with a small rubber tube and small cigarette drain.

The postoperative convalescence was not remarkable. For the first few days there was considerable drainage of blood and urine. These very shortly decreased in amount and in a week the patient began to void through the normal route. Ten days postoperative, drainage ceased by perineal incision. The patient was discharged with incision completely healed and in good condition on the eighteenth day. It is now a year and a half since operation and during this period he has remained in excellent health.

We feel that this case is worthy of presentation because of its rarity as a clinical entity. I have been informed by our Department of Pathology that multiple small cysts of the prostate are commonly found at autopsy. In no case, however, have they caused symptoms. Here and there in the literature we find cases described, but these are exceedingly rare and have been ably reviewed in a recent article by Dr. Miley Wesson of San Francisco. We hope that the report of this case will be of some help to others in the diagnosis of this condition.

SARCOMA OF LONG BONES[*]
CLINICAL LECTURE ON END RESULTS

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Bone Sarcoma. Exhibition of patients illustrating end-results of treatment.

CASE I. C. S., male, aged thirty-nine years. Periosteal osteogenic sarcoma of tibia involving 6 inches of shaft, with extensive metastases in the femoral, inguinal and iliac glands. The patient was treated with the mixed toxins of erysipelas and Bacillus prodigiosus combined with radium (March, 1917). *Result:* complete recovery, limb saved, patient in excellent health at the present time, ten and one-half years later.[1]

In this case, the microscopic diagnosis by Dr. James Ewing was confirmed by the Committee of the Bone Sarcoma Registry (registered as Case No. 183). It is of special interest inasmuch as it is the only registered case of periosteal sarcoma in which the limb was saved and the patient remained alive for a period of more than five years. Furthermore, it is the only case in the Bone Sarcoma Registry in which a patient with metastases has been cured by any method of treatment, with the exception of two other cases of Dr. Coley that have remained well for seven and eight years respectively, both of which were treated with toxins and radium.

CASE II. R. H., male, aged thirty-six years. Very extensive inoperable sarcoma of middle and upper third of shaft of femur involving as far as the trochanter (clinical and roentgen-ray diagnosis). This was a malignant, rapidly-growing sarcoma of the femur (probably of the endothelioma type) which was entirely inoperable at the time of Dr. Coley's first observation in October, 1917. The tumor followed a recent fracture, and completely destroyed 5 inches of the shaft. There was a pathological fracture. *Treatment:* injections of the mixed toxins for eight months and one radium-pack treatment. *Result:* complete recovery, reunion of bone (5 inches' shortening); patient has a useful limb and is able to walk about without a crutch or cane, ten and one-half years later.[2] This is Case No. 210 in the Bone Sarcoma Registry. (See Figs. 1 and 2.)

FIG. 1. Inoperable sarcoma (probably endothelial myeloma) involving one-half of shaft of femur; destruction of five inches of shaft. Pathologic fracture. Complete recovery under eight months' treatment with toxins of erysipelas and Bacillus prodigiosus and one treatment with radium pack (40,000 mc.-hrs.). Firm union of bone; patient well ten years later. For roentgenograms before treatment *vide Archives of Surgery* (Coley) January, 1927.

CASE III. H. S., male, aged eight years. Periosteal sarcoma of fibula (Ewing's diagnosis: endothelioma) with extensive metastases in femoral, inguinal and iliac glands, and also in lungs. Treated by amputation (May, 1920) followed by toxin treatment for four months and one

application of radium pack to large mass (size of child's head) in iliac fossa. *Result:* complete disappearance of metastatic tumors. Patient well at present, seven and one-half years later. (Treated at the Hospital

FIG. 2. Patient of Figure 1 five and one-half years after treatment was begun.

for the Ruptured and Crippled and Memorial Hospital.)

In this case, a gland in the groin was removed at biopsy and examined microscopically by Dr. James Ewing, who pronounced it a sarcoma of the endothelioma type.[3] This is Case No. 267 in the Bone Sarcoma Registry. (See Fig. 3.)

CASE IV. L. G., female, aged nineteen years. Central sarcoma of entire lower end of femur with extensive involvement of knee joint. Ewing's diagnosis: giant and spindle cell sarcoma of moderate malignancy. Bone Sarcoma Registry diagnosis: benign giant cell tumor. A biopsy was performed, but no curettage. *Treatment:* injections of the mixed toxins of erysipelas and Bacillus prodigiosus (no other treatment). *Result:* complete recovery; limb saved; 2 inches' shortening of bone and stiff leg. Patients walks without support of any kind, and is in excellent condition

thirteen years later.[4] This is Case No. 180 in the Bone Sarcoma Registry.

Three years ago she developed a rapidly growing tumor of the right breast; good recovery. Extensive involvement of the

FIG. 3. Periosteal sarcoma of fibula, endothelial myeloma type (Ewing) with extensive metastases in the groin and iliac fossa (diagnosis confirmed by microscopical examination) also metastases in lungs. Amputation followed by three months' treatment with mixed toxins of erysipelas and B. prodigiosus; one radium pack treatment to large metastatic tumor in iliac fossa; no radiation of chest. Complete recovery; patient well seven and one-half years later.

breast, pronounced carcinoma by Dr. Ewing and Dr. Wood. Patient was given prophylactic toxins and local roentgen rays. No recurrence in more than three years.

CASE V. C. F. female, aged seventeen years. Central sarcoma of upper end of tibia. Ewing's diagnosis: giant cell sarcoma of epulis type, very moderate degree of malignancy. Pronounced malignant by Drs. George Barrie and MacCarty of the Mayo Clinic. *Treatment:* curettage and toxin treatment for three months. On discontinuing treatment a recurrence took place. Second curettage followed by further toxin treatment and one application of radium pack. *Result:* complete recovery;

limb saved; patient well over twelve years later.[5] This is Case No. 145 in the Bone sarcoma Registry. (See Figs. 4, 5 and 6.)

Case vi. H. J., male, aged twenty-two years. Periosteal sarcoma of femur (Ewing: endothelioma type) treated with toxins for six weeks before amputation; temporary decrease in size of tumor. Amputation in December, 1909, followed by two courses of toxin treatment. *Result:* patient well seventeen and three-quarter years later.[6] This is Case No. 398 in the Bone Sarcoma Registry.

Case vii. H. S., male, aged nineteen years. Periosteal osteogenic sarcoma of femur, treated with toxins and radium before amputation. Temporary improvement. Amputation performed, followed by prophylactic toxin treatment. *Result:* patient well over seven years after amputation.[7] This is Case No. 172 in the Bone Sarcoma Registry.

Case viii. E. M., male, aged forty-seven years. Perisoteal sarcoma of upper two-thirds of humerus (endothelioma type) inoperable. Registry diagnosis: endothelioma or Ewing's tumor. Treated with toxins and radium. *Result:* complete recovery, reunion of pathological fracture, patient has perfect function three and one-half years later.[8] This is Case No. 596 in the Bone Sarcoma Registry.

Case ix. J. L., male, aged twenty-one years. Periosteal osteogenic sarcoma of femur. Treated with radium for three months without control of tumor. Amputation, followed by prophylactic toxin treatment. *Result:* patient well three and one-third years following amputation.[9] This is Case No. 598 in the Bone Sarcoma Registry whose diagnosis was that of osteogenic sarcoma.

Case x. E. P., female, aged thirty years. Periosteal osteogenic sarcoma of lower end of femur. Treated with prolonged radiation and a short course of toxin injections, without controlling tumor. Amputation performed followed by prophylactic toxin treatment. *Result:* patient well over ten years after amputation.[10]

This is Case No. 100 in the Bone Sarcoma Registry.

Case xi. I. H., male, aged thirty-six years. Giant cell sarcoma of lower end of femur. *Treatment:* excision of one

Fig. 4. Very extensive giant- and spindle-cell sarcoma of lower end of femur with involvement of knee-joint. Biopsy but no curettage. Toxin treatment for nine months. No radiation. Complete recovery, $2\frac{1}{2}$ inches' shortening; stiff knee; otherwise useful leg. Patient well thirteen years later.

condyle by Dr. Hartwell and Dr. Dudley in June, 1923. A recurrence took place one year later, following which the patient was put upon high voltage roentgen-ray treatment administered by Dr. Herendeen. *Result:* patient in good health

with no recurrence, four years after the first operation. While there is considerable limitation of motion, the patient is able to walk very well with a cane.[11]

CASE XII. G. M., male, aged twenty-six years. Benign giant cell sarcoma of lower end of femur, of very extensive involvement. Pathological fracture. Treated with radium by Dr. Quick (90,000 mg.-hrs. in nine months' pack treatment). *Result:* reunion of fracture, full

FIG. 5. Preceding case one year after treatment.

restoration of function, patient in good condition five and one-half year later. While there is at present some dermatitis resulting from early radium treatment, and considerable atrophy of the soft parts due to endarteritis, the patient has a useful limb and there is no evidence of a recurrence.[11] This is Case No. 320 in the Bone Sarcoma Registry.

CASE XIII. K. K., female, aged seventeen years. Giant cell sarcoma of lower end of tibia, recurrent after two operations. Recovery under prolonged toxin and roentgen-ray treatment. *Result:* limb saved, complete restortation of function, patient in good health twenty-three years later.[12]

CASE XIV. L. D. G., male, adult. Sarcoma of lower end of radius with complete destruction of bony shell and three inches of bone. *Treatment:* systemic injec-

tions of mixed toxins of erysipelas and Bacillus prodigiosus. *Result:* complete disappearance of tumor regeneration of bone, restoration of function, and patient in good condition nine years later.[13] This is Case No. 211 in the Bone Sarcoma Registry.

CASE XV. W. B., male, aged twenty-eight years. Inoperable osteogenic sarcoma of occipital bone following recent trauma; there was complete destruction of both tables of the skull. Exploratory operation

FIG. 6. Preceding case five years after treatment; showing Nature's attempt to form new condyle.

revealed a tumor extending down to the dura. Diagnosis was confirmed by microscopic examination by Dr. James Ewing. *Treatment:* systemic injections of toxins combined with local radium treatment for eight months. *Result:* complete recovery; clinical and roentgen-ray examination shows no evidence of disease three years later. (See Figs. 7 and 8.)

This case is a typical example of acute traumatic malignancy. The tumor started in a small hematoma, two weeks after an injury caused by a heavy wooden packing-case falling and striking the patient on the top of his head.[14]

CASE XVI. S. D., female, aged eighteen years. Very extensive periosteal osteogenic sarcoma of lower end of femur. Registry diagnosis: osteogenic sarcoma. Patient was very emaciated at the time of exploratory operation (March, 1906) and the prognosis was very grave. *Treatment:* amputation followed by prolonged prophylactic toxin treatment. *Result:* patient in excellent health, twenty-one and one-half years after amputation.[10] This is
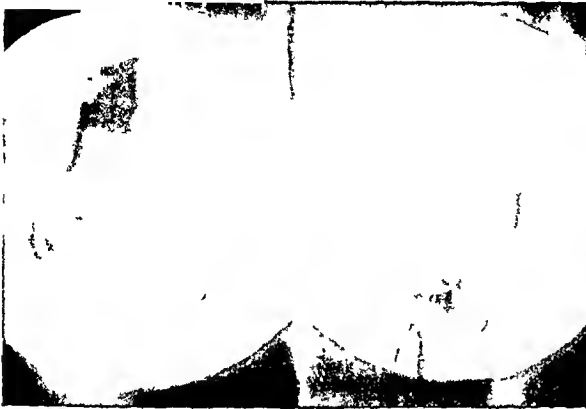
FIG. 7. Osteogenic sarcoma of occipital region of skull involving both tables and extending to dura mater. Recovery under toxins and radium-pack treatment. Patient well three years later.

Case No. 408 in the Bone Sarcoma Registry.

CASE XVII. C. P., male, aged twenty-eight years. Sarcoma of tibia and fibula (angioendothelioma type) with multiple metastases in the lungs. *Treatment:* toxins and roentgen ray. Temporary control. Amputation performed three years later, followed by prophylactic toxin treatment. Patient in good condition one and one-half years later. This is Case No. 574 in the Bone Sarcoma Registry. This patient has received a very large amount of radiation—roentgen rays, twenty-five exposures, eighty minutes each—without any ill effects.

CASE XVIII. J. R., male, aged nine years. Myositis ossificans. In the following case, the clinical and microscopic findings closely resembled those of osteogenic sarcoma. The patient fell, striking his shoulder on a hard floor. A swelling developed

almost immediately after and increased in size; this was accompanied by a temperature of 101 or 102° F. Clinically the condition seemed characteristic of osteomyelitis. An exploratory operation was performed by Dr. J. F. Black, revealing a tumor in the upper end of the humerus, apparently springing from the periosteum. A mass of tumor tissue, firm in consistency, measuring about $\frac{1}{2}$ by 2 inches, was removed and examined microscopically. The diagnosis

FIG. 8. Preceding case three years after treatment was begun.

of the local pathologist was that of osteogenic sarcoma, which was confirmed by Dr. Ewing and Dr. Wood. The condition was apparently inoperable. The patient was referred to Dr. Coley and admitted to the Hospital for the Ruptured and Crippled in early February, 1927.

The toxin treatment was begun, and in a short while the swelling diminished markedly in size. At the end of two weeks a hard, bone-like tumor could be felt posteriorly, apparently connected with the upper end of the humerus. No radiographs could be taken for two weeks because the ward was under quarantine. At the end of this time, roentgen-ray examination showed a condition entirely different from

five to twenty years later. In 2 cases metastases had developed.

DISCUSSION BY DR. COLEY

In connection with the presentation of case histories illustrating the end-results in sarcoma of the long bones following different methods of treatment, time will permit only a very brief discussion of the choice of methods; and I shall merely touch upon the difficulties associated with the early diagnosis of bone sarcoma, which sometimes are real and troublesome. Those who wish to know more about my views upon bone sarcoma are referred to my longer paper on the subject published in the *Archives of Surgery*[1] and to a more recent publication in the *Annals of Surgery*.[17]

It may be recalled that I was one of the earliest surgeons to advocate the conservative treatment of sarcoma of the long bones, having published a paper on the subject in 1907,[18] and another at the Congress of French Surgeons in 1919. While I continue to be a firm believer in conservative treatment, I think that I am now regarded by many of my colleagues as being too radical, because further experience with the disease has led me to the conclusion that conservative treatment has certain definite limitations, depending upon the histological and clinical type of the tumor in question. I believe that amputation alone is able to cure but a very small number of cases of periosteal osteogenic sarcoma; but early amputation followed by prolonged treatment with the mixed toxins of erysipelas and Bacillus prodigiosus, in my experience, has resulted in an apparent cure in 50 per cent of the cases of periosteal sarcoma (osteogenic, including endothelioma). In proof of this I cite the results in a group of 40 cases treated by this method: 20 have remained well from three to eighteen years.

In regard to radiation: for more than ten years the Memorial Hospital has been the fortunate possessor of a very large amount of radium; and in view of the practically hopeless prognosis of periosteal sarcoma under surgical treatment alone, a serious effort has been made to determine whether or not better results were obtainable by radiation. During this period, nearly all the cases of bone sarcoma, including giant cell sarcoma, that applied to the Memorial Hospital have been treated by radiation as the method of choice. However, personal cases and those that have come under my own care at the Hospital for Ruptured and Crip-pled, I have continued to treat in the old way, that is, the giant cell group by curettage followed by toxins, alone or combined with radium; the osteogenic group, by early amputation followed by toxins; and in the group of rapidly growing round cell sarcoma of the shaft (now generally classified as endothelioma or Ewing's tumor) I have made an attempt to save the limb by a thorough course of systemic injections of the mixed toxins combined with local radiation, reserving amputation for only such cases as failed to show marked improvement under this treatment. The results obtained by these various methods of treatment have been recorded in the papers already mentioned.

While the Memorial Hospital has definitely proven—and I believe was the first hospital to prove—that giant cell sarcoma of the long bones may be cured by radiation alone, since 5 cases there treated have remained well for more than five years, I am not yet convinced that radiation is the method of choice. My two main reasons for this opinion are: (1) because of the longer period of time required to effect a cure and the correspondingly longer period of disability, an important matter with working men; and (2) because it is impossible to make a correct diagnosis of giant cell sarcoma of the long bones in more than 75 or 80 per cent of the cases from clinical and roentgen-ray evidence alone. We have found in 1 out of 4 cases at the Memorial Hospital, diagnosed clinically and by roentgen ray as benign giant cell tumor, and the patient treated for a long time by radiation alone, that the tumor later proved to be a malignant central sarcoma; but by the time this discovery was made, the condition had become inoperable and all chance of saving the patient's life had been lost. Therefore, I now regard the following treatment of giant cell tumors to be the method of choice: (1) thorough curettage down to hard bone; (2) washing out the cavity with pure carbolic acid or zinc chloride; (3) packing the cavity with sterile gauze; (4) keeping the cavity clean with Dakin's solution; and (5) a few days after operation, starting a three or four months' course of prophylactic toxin treatment. In advanced cases, a single radium pack treatment might be used to advantage, but this should not be done until the cavity has been nearly filled by normal granulation, since radium increases the chances of infection. I believe that the dangers associated with

curettage are no longer a serious drawback, since the introduction of Dakin's solution has made it possible to keep the wound clean. In my opinion, the method just cited makes it possible to save the limb in practically all cases of giant cell sarcoma, even those of the lower end of the femur with extensive involvement of the knee joint. I have had 2 such cases, one of which has just been presented. In the other, in which the disease was even more extensive, one treatment with radium was given after three months' treatment with toxins and after the cavity had filled up; this patient is alive and well, with perfect function, eight years later. This method, I believe, enables one to study the histology of the tumor, and thereby to eliminate the one-in-four error in diagnosis associated with treatment by radiation alone without biopsy—the method at present advocated by some surgeons and many radiologists. Simple biopsy without a complete curettage should never be done in giant cell tumors because of the danger of hemorrhage and the increased risk of infection.

Coming to periosteal osteogenic sarcoma of the long bones, the results obtained in 71 cases treated at the Memorial Hospital by radiation alone, as a primary method of choice, have led me to conclude that this method is associated with very definite risks, and is not the method of choice. The number of cases thus treated, I believe, is sufficiently large to include some cures, but as yet no case in which the diagnosis has been definitely established by biopsy has recovered under radiation alone and the patient remained well for three years. In 25 cases, the condition became inoperable, or the patient developed metastases while undergoing local radiation; and this, in spite of the fact that improvement in the local condition was noticed in several cases. In 29 cases in which amputation had to be resorted to after failure to control the tumor by prolonged radiation, only 2 patients survived the five-year period. In other words, primary treatment of an osteogenic sarcoma by radiation alone in my opinion distinctly lessens the chance of a cure by later amputation.

If amputation alone were the only alternative, one might feel that there were little choice; but when it has been found possible, as it has been, to save the life of the patient in 50 per cent of the cases by early amputation (before radiation) followed by toxin treatment, then it would seem that herein lies the method of choice.

Some surgeons have advocated preliminary radiation in early cases of osteogenic sarcoma, and in the event of no improvement, this to be followed several months later by amputation. The value of such a practice may be determined only by actual experience; but at present we have 32 cases so treated, of which only 3 have survived three years. The figures show little if any improvement over those of the group treated by early amputation alone, and far less than those treated by early amputation followed by toxin treatment.

In the group of so-called endothelioma, I believe that the prognosis after amputation alone is as grave as that found in osteogenic sarcoma, and that the former are even more prone to early metastases. On the other hand, all of these cases have been found to be very sensitive to radiation as well as to toxins; while the Bone Sarcoma Registry showed some cases of this type treated by radiation alone well for over four years, in most instances, after marked improvement has taken place (in some cases amounting to the entire disappearance of the tumor), the disease has recurred locally or in the form of metastases, and has proven fatal. Some of these cases of endothelioma have been cured by toxins alone and more by toxins and radium. I believe the method of choice for this group is as follows: local treatment by radium pack or roentgen ray combined with prolonged systemic treatment with the mixed toxins of erysipelas and Bacillus prodigiosus. The fact that a number of patients with extensive multiple metastases have recovered and remained well for from five to ten years following such treatment, in my opinion justifies a more general use of this method. In addition, a number of limbs have been saved by the adoption of this method. In my paper already referred to, the results in the endothelioma group are given as follows: of 26 cases of endothelioma, including round cell sarcoma without new bone formation, 13 are alive and well from three to fifteen years after. The treatment employed in these 13 cases was: operation and toxins in 4 cases; toxins and radium (in 2 cases after amputation) in 6 cases; operation and radium in 1 case; toxins alone in 1 case; radium alone in 1 case (this patient died at the end of three years; case of death unknown; no local recurrence).

Of our entire series of cases treated at the Memorial Hospital and at the Hospital for Ruptured and Crippled, we have no case of endothelioma of the long bones treated by radiation alone that has remained alive and well for more than three years.

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EDITORIALS

SURGEONS—REAL AND PSEUDO

IN most states one graduates from a medical school, passes a state board examination and is licensed to practice medicine and surgery. In New York State it so reads on the diploma granted by the University of the State of New York.

Without further training or experience the licensed practitioner is permitted by law to do any major surgical operation. His activities are limited only by the degree of faith he instills in the patient.

During the past thirty years surgery has been revolutionized. The finished surgeon successfully operates for conditions that were a half century ago almost always fatal. Surgery today is a commonplace. Men possessed of surgical ability are to be found in every hamlet and at every crossroad.

However, there is a class of physician who will attempt anything for financial gain. He is worse than the casual surgeon. Many of these men never have had an interne's life or worked as an apprentice to a surgeon of recognized ability.

These untrained men graduate, pass a state board examination, open offices and lay in wait for the unsuspecting victims. Without apprehension these surgical prostitutes attempt major surgery. A plausible tongue explains mortality. Morbidity is an unknown condition to this horde; a patient is marked "recovered" if he or she leaves the sanitarium alive. Naturally these men are never Fellows of the American College of Surgeons. They usually are connected with nothing. They possess keen financial judgment and ability, and are able to diagnose the size of the patient's ability to pay far better than the pathological condition—if present.

This state of things gives medicine, and especially surgery, a black eye, and the sound, ethical man suffers in turn.

What is the cure? We hesitate to suggest remedies! We are anxious to hear what our readers have to say on the subject. One man will urge that all graduates be compelled to become hospital internes; another, that legislation should be enacted making

major surgery possible only to those of training and skill; another might suggest that the American College of Surgeons educate the lay public to demand only a surgeon who is a Fellow of the College thereby knowing they have a surgeon both in fact and name and not a "specialist in all the branches of medicine."

This is not a new topic. The American College of Surgeons have hammered at this abuse and, as is their custom, made an excellent crusade. But withal the abuse is apparent and gains in size. There must be a remedy. It is time a stop was called to the activities of these surgical vultures.

JACOB SOLIS COHEN

JACOB Solis Cohen, who died on December 22, 1927, was one of the most notable figures in the history of laryngology in the United States.

Dr. Solis Cohen was born on February 28, 1828, in New York City. Through both his father and mother he came of the very best Jewish stock. For hundreds of years his ancestors were active in public affairs and prominently connected with charitable and religious projects. His mother was the daughter of Jacob da Silva Solis, a wealthy philanthropist of New York, and through her he was related to the Hays and Etting families, both of which had been prominent in the patriotic cause during the Revolution. In 1840 his father moved to Philadelphia. After graduating from the Central High School young Solis Cohen attended lectures at Jefferson Medical College, but finished his medical education at the University of Pennsylvania. He received the degree of M.D. in 1860. He was appointed resident physician in the Philadelphia Hospital, but resigned at the end of six months to enter the United States Army. As no commission as an assistant surgeon was available, young Solis Cohen enlisted as a private soldier, but soon after received a commission as Assistant Surgeon in the 26th Regiment, Pennsylvania Volunteers.

He served with this regiment in Hooker's Brigade. In September, 1861, he resigned from the Army to accept an appointment as an acting assistant surgeon in the United States Navy. He accompanied Dupont's expedition to Port Royal, and served on the South Atlantic Blockading Squadron of which he was for a time acting fleet surgeon. After resigning from the Navy in January, 1864, he was appointed visiting surgeon for two of the military hospitals then established in Philadelphia. At the Turner's Lane Hospital he performed one of the ninety-four successful ligations of the femoral artery done by army surgeons during the war.

About this time his attention was directed towards the then young speciality of laryngology. In 1867 he was made chairman of a committee of the American Medical Association to investigate the value of treatment by means of inhalation. His studies resulted in the publication of his first book, "Inhalation in the Treatment of Disease: Its Therapeutics and Practice," Philadelphia, 1867. A second edition appeared in 1876. In 1872 Solis Cohen published "Diseases of the Throat and Nasal Passages," which at once became a standard textbook. A second edition was published in 1879, and subsequent editions attest the continued popularity of this excellent work. In 1874 appeared his monograph, "Croup in its Relations to Tracheotomy," based on a study of over five thousand recorded cases. This work achieved a remarkable and well-deserved success. In 1879 he wrote for the "Health Primer" series a small book "The Throat and Voice." In addition to these books Solis Cohen contributed monographs on laryngological subjects to the more important encyclopedic publications of the day, such as the "International Encyclopedia of Surgery," and the "American System of the Practice of Medicine." He contributed many important papers to medical societies and current periodical medical literature. For many years he edited the laryngological department of the *American Journal*

of the Medical Sciences, and was one of the editors of the *Archives of Laryngology*. A profound scholar and a facile writer, his literary productions bear the mark of the highest culture as well as of scientific ability.

Solis Cohen was a bold and skilful operator, his training in general surgery standing him in good stead in his special field. In 1892 he performed a famous laryngotomy on a patient in the Jefferson Hospital, the Jefferson Medical College Hospital, on the opening of that institution. After teaching laryngology for many years in Jefferson Medical College he was made Honorary Professor of Laryngology there in 1883. One of the founders of the Philadelphia Polyclinic, he served for many years as Professor of Diseases of the Throat and Chest. He was also visiting physician to the German Hospital, physician to St. Mary's Hospital, and consulting physi-

Jacob Solis Cohen (1828–1927).

introducing several original features in technique. The patient lived many years after the operation and the writer of his notice heard him converse in a voice which was perfectly audible at a distance of fifteen feet.

Solis Cohen held many official positions. In 1871 he delivered the Mütter Lectures at the College of Physicians of Philadelphia. He was Professor of Physiology at the Wagner Institute of Science in Philadelphia. In 1867 he was appointed Lecturer on Electric Therapeutics in the Jefferson Medical College, and was one of the first visiting physicians elected to cian to the Jewish Hospital. He was deeply interested in tuberculosis and was one of the early advocates of its outdoor treatment, serving as senior and consulting physician to the Home for Consumptives at Chestnut Hill, Philadelphia, and furthering Trudeau's work at Saranac most enthusiastically.

Solis Cohen was a Fellow of the College of Physicians of Philadelphia. He served two terms as president of the Philadelphia County Medical Society, and was an honorary member of the Neurological Association of New York, of the Sociètè Francaise de Laryngologie, and of the

British Association of Laryngology and Rhinology. He took a very prominent part in the affairs of the American Laryngological Association, of which he was one of the founders, and was twice elected president. At the meeting of the Association in Washington in 1910, he was presented with a loving cup. He was also a member of the American Philosophical Society. Because of his war services he belonged to the Loyal Legion and other military orders and societies. He received honorary LL.D.'s from Jefferson Medical College and Temple University.

Dr. Solis Cohen had many interests besides those of study appertaining to his profession. He was an active member of the Academy of Natural Sciences and of the Franklin Institute, giving lectures at the latter on acoustics, as he also did at Stevens Institute and at Wagner Institute. For many years he was interested in various movements for political reform. He was a devoutly religious man and a profound Hebrew scholar, taking an active part in the work and worship of his synagogue, and aiding in the establishment of the Hebrew Educational Society, of which he was for a time the secretary.

Solis Cohen was greatly loved and respected throughout his long life. Behind his quiet, modest mien there was felt the force of a profound intellect and a strong will, and his influence for good was very great and will last long after he has departed to his well-earned repose.

FRANCIS R. PACKARD.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

JOSEPH SCHMIDT, BARBER-SURGEON

Leroy Crummer, m.d.

OMAHA, NEB.

PRACTICALLY contemporary with Molière, whose merits as a true benefactor of medicine have recently been so well postulated by Courtney,[1] was Joseph Schmidt, Barber-Surgeon, of Augsburg. His life was the antithesis of the careers of the members of the Paris Faculty, whose faults were so caustically depicted by the famous French dramatist. His was not the pride of college, nor degree. He had no desire for the honors of the long robe, nor was he self-deceived concerning his position in life nor his aim in aiding the distressed. His portrait shows, I think, his satisfaction in the short robe, and he must have been quite willing to be classed with his famous predecessors, Braunchweig, Gersdorf, Hildanus, Bartsch and Paré, all of whom, save Paré, remained barber-surgeons to the end; and their methods and results mark the high places of surgery of the period, while the efforts of surgeons of the long robe have been forgotten and the pose of the faculty concerning surgery brings an ironical smile to the lips.

The history of surgery from the Rennaissance to the Reformation is one long story of academic arrogance and resistance to innovation. Those who sat in the high places arrogated to themselves the power of conducting the relationship of the profession to patients, with total disregard of the psychology and habits of the latter. While those in power were so intent on conduct and etiquette, now termed ethics, practically every innovation was forced from below. While Saint-Côme might discuss the method of giving a female patient a clyster without touching the adjacent parts, the barbers were in actual practice attending to the injuries, the accidents, the deformities and the suffering of the sick, often forced to attempts to give relief, and not infrequently finding methods which were successful.

Of this type of surgeon who remained close to his people was Joseph Schmidt, "Barbirer Leib und Wund-Arzt," of Augsburg. Having made no great discoveries nor advanced the course of surgery in any well-organized form, he has remained practically unknown. The biographical dictionaries have but meager information, based only, it seems to me, on the survival of several books written by him, in one of which his portrait giving his age justifies the computation that he was born in 1601. His "Spiegel der Anatomiae" is most fascinating, and behind it is the story of the evolution of the format of books on anatomy, in the dedication and preface are hints concerning the state of the practice of surgery in the first half of the

[1] Courtney, J. E. Molière and the Faculty. *Ann. Med. Hist.*, N. Y., 1925, v. 309.

seventeenth century, and between the lines can be gauged the mental and practical equipment of the author.

This "Mirror of Anatomy" is one of the earliest if not the earliest effort to produce a pocket compendium of anatomy. Attempts to fit the subject matter of anatomy to the proper book format began immediately after the publication of the master work of Vesalius and continued long after the period when Joseph Schmidt thought he had the proper solution. The unwieldy Fabrica yielded almost at once to the more easily handled thin folios of Geminius and Valverdus. This format was reprinted and copied a dozen times to one new edition of the Fabrica in its old form. Efforts by several publishers to pirate and print the text of Vesalius in smaller volumes without the illustrations of Van Calcar were frank failures, in spite of the famous name of Fuchs on the title page of one of these piracies. Paré in his "Anatomie Universelle," Paris, 1561, published an illustrated work in octavo which must have been a success since so few copies have survived, but this attempt was not repeated. Variola and Albertus published books with a few illustrations in octavo, and editions of Columbus and Fallopius without illustrations are not uncommon. Aselli's "De Lactibus," originally published in quarto with folio plates, had been twice reprinted with the plates re-ingraved in quarto. The works of Vesling and Bartholinius, in smaller format, were issued in the same decade as this effort of Schmidt, so we can give this author credit for making a true claim when he gives in his preface as his final reason for publishing his "Spiegel": "Especially however in the comfortable *form to which illustrations of all* times were added, none to my knowledge have hitherto been published and not everybody can buy one of the big expensive anatomies or even carry it with him." He makes this claim even more definite on the false title which divides the two parts of his work. This title speaks first of the cuts

of all parts of the body drawn from life with the most accurate description, and adds "hitherto never brought together in such a small anatomical work."

There is a world of information buried in the dedications, prefaces and introductions of these old books. The poems of praise dedicated to the authors and the poetical efforts of the authors themselves, which are found in many of these books, also yield information scarcely considered by medical historians. Even Vesalius attempted this form of poetry. From the preface of the "Spiegel" may be ascertained that Schmidt came from a family of barber-surgeons. His father belonged to the guild and properly instructed Joseph and his brothers in the secrets and art of surgery, including home training in anatomy. Joseph Schmidt had the definite appointment of staff surgeon to Captain Artoloria, serving five years, and upon the basis of this army experience he wrote and published in 1644 at Augsburg, "Examen Chirurgicum."[1] He also tells us that he had continued his anatomical studies while with the army and had prepared and mounted skeletons "of which two still exist."

Of greater interest perhaps than these strictly personal details is the insight to be derived from studying his preface concerning his methods of thinking and writing and the beliefs and superstitions prevalent at this period. The dedication, addressed to eleven of his superior friends at Augsburg, breathes with the spirit of the fundamentalists, convinced of their eternal truth; he repeats the theological dogmas which guided thought disasterously through the doctrine of signatures and similar superstitions for so many years. The basis of much irrational medical thought may be found in the belief in the false syllogism: Since God has created man in his own image, he has concealed somewhere the material means for the alleviation of

[1] *See, Index Catalogue* of the Library of the Surgeon General's Office, U. S. A.

man's sufferings, therefore, the man who can find these secrets is the wisest man. Such an argument Schmidt advances in the entire context of his dedication.

The preface "to the Benevolent and Art-loving Reader" relates those details in his experience which qualify him to present the subject of anatomy. One gem

FIG. 1.

may be translated thus: "The knowledge and practice of this praise-worthy anatomical art is not only for the graduate physician, but for the right busy surgeon or wound doctor it is also useful and necessary in many ways."

In spite of his clear mind, he does not fail to conform to illustrious precedents, and introduces his preface with his conception of the comparison of the macrocosm and microcosm, which contains much that is old and very little that is original. The universe has three parts, heaven, air

and earth,—so also has the body three parts, the head, the chest and the abdomen; as heaven is round, so is the head——and then he forgets his comparisons in his enthusiasm over the importance of anatomy.

Following the preface is a poem, probably written by the author himself, since it is not signed and similar ones may be found in other volumes of his works; it is fifty-six lines long and occupies two full pages. Translation of the words might be possible, but the spirit can be appreciated only in the original, so the last lines are reproduced:

Du trewer Artzt hör den bericht;
Wo du für Gott wilt recht bestahn/
Ein rein Gewissen für ihm han;
Wo du wilst deinem Rechsten gut
Recht dienen/wie Gott heissen thut/
So lass dir die Anatomy/
Ein Schlüssel seyn zur Artzeney:
Du solst sie wie ein Ruder han/
So wirst für jedem recht bestahn.

The collation of the book is as follows: "Spiegel der Anatomiae, Darinn zu sehen alle innerliche und ausserliche Gliedmassen des Menschlichen Leibs, Auff das kürtzest verfast. Durch Joseph Schmidt, Barbirer Leib und Wund Artzt. Johan Weh, Augsburg, 1646." 12 mo. 12 ll. 457 pp. (wrongly num. 455). Engraved title, engraved portrait, 82 full page copperplates."[1]

The copperplates in it are signed "H. Radel, fecit." This artist has remained unnoted in Bartsch, Bryan, and other available biographical dictionaries. He may well have been the local goldsmith since at this period engraving was not an uncommon adjunct to the goldsmith's craft. Radel certainly was industrious and not devoid of ideas, although his technique may not have been of the best. In his title page design (Fig. 1) he could not resist the *momento mori* motif, but he surely added some novel details. The portrait is most attractive and represents personality much better than many of the contemporary portraits by greater artists. In this portrait, Schmidt is shown as a man of forty wearing

[1] Not in Haller, Gurlt, Defeyfer or Choulant.

with pride the short robe of the barber-surgeons. The tools of his craft lie on the table before him, and the escutcheons and emblems of his guild are added to the plate as decorations. (Fig. 2.)

The 82 copperplates, many having several figures, give a comprehensive view of the anatomical details of the entire body.

FIG. 2.

without exception. The technique of etching has been reserved to the greatest artists, probably on account of the difficulties of the process, so that the method adopted by Radel was not without its difficulties and his results must be estimated from this standpoint. Viewed in this light, it must be acknowledged that his illustrations are

FIG. 3.

These figures are all copies, the originals of which may be found in Vesalius, Valverdus, Coitier, Pineaus, and Ceasserius. The modifications and combinations necessary to adjust these folio illustrations to the duodecimo pages are so ingenious that in most cases the essential details are not disturbed. Careful inspection shows that all of these plates are etched instead of being engraved. In previous anatomical illustrations, the line wood block and the engraved copperplate were used almost
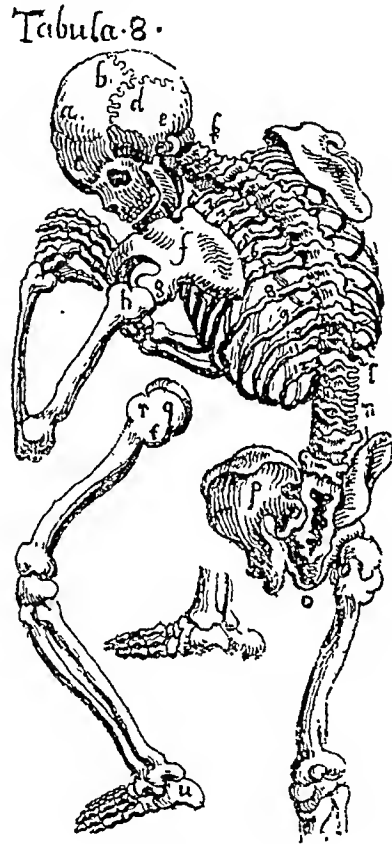
much more suitable than the first inspection indicates. (Fig. 3.)

The text itself is divided into two parts. There are 208 pages of purely descriptive anatomy; then, after the false title quoted above, there follow (pages 211 to 450) references by table and index number to the illustrations, which are all bound together at the end of the book. Nowhere is there any indication of the originals from which the illustrations were taken. The text concludes with a poem of five pages addressed to the "common barber": after epitomizing the anatomical names, the poem flows on to indicate that there were

the same problems of stealing patients, of ignorant associates, and other trade evils—not entirely done away with during the passing years.

Schmidt was rather a frequent contributor to medical literature. He is represented by at least four titles in the catalogue of the Surgeon-General's Library.
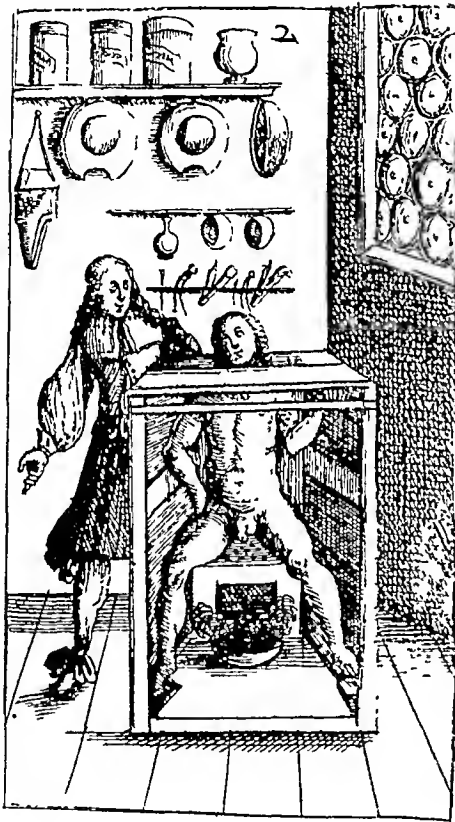
FIG. 4.

He seems to have continued his activities at Augsburg, for the dedication to his "Kürtzer . . . bericht, dreyer Erblicher Kranckheiten, . . . die pest, Frantzosen, und scharbockh, . . . " is dated at this city in 1667. This book was issued by the same publisher and illustrated by the same artist as the "Spiegel" of twenty years before. Ripe now in the experience of many added years of active practice, Schmidt qualifies as "barbierer, geschwornen Staff-brech-und wund-artzt." While

addressing his work to barber-surgeons as before, now he does not hesitate to direct his advice to the young physician also.

In this volume, he treats of the pest, syphilis and scurvy. In the preface is the interesting statement that he personally had observed eight epidemics of the pest in Augsburg in his forty years' practice. In the text itself, he includes "a little chronicle" which postulates almost forty pest years in Augsburg between 1042 and 1667. The syphilis tract is full of interest; he accepts the idea of the Neapolitan origin; he divides the secondary phase into four types; he describes extragenital infection; he advocates mercurial treatment as well as the "wood," and the vegetable alteratives. Radel has contributed 20 etchings to this part of the book. Many plates show cuts of the highly ornamented surgical instruments of the period. A few depict operations, but the most attractive is a series of four plates representing treatment by fumigation in the consultation room of the barber. The details of the room, the bath cabinet, the position of the patient and the pose and costume of the barber make these etchings true genre pictures, which may rank with the lesser work of the famous Dutch contemporary, Jan Steen. (Fig. 4.)

In the last tract, there is a marked difference of thought and expression. Schmidt confesses that he has had very little personal experience with scurvy, having seen only a few cases and these during his army experience. He attempts to mask his own lack of knowledge by quotations from many authorities, with the inevitable result that this tract is much below his usual practical standard.

Should there be a moral to this tale? Schmidt's title, "The Mirror of Anatomy," is certainly suggestive. He looked into the mirror and was so well satisfied with his methods, knowledge and beliefs, that he gave them forth to the world in many volumes. Today, we use other methods, discount almost all his knowledge and characterize his beliefs as superstitions; but

should not our mirror tell us that we too perhaps place too much confidence in present day methods, knowledge and beliefs, which future students may also find absurd?

BOOK REVIEWS

We know of no occupation more fascinating than opening the covers of a new book and going on a mental pilgrimage of discovery through the pages. Once in a long time a thrilling surprise rewards the searcher. If one pursues the quest diligently he is sure to be pleasantly surprised at every turn. This was especially true this month. The books sent us for review made an impressive pile and we would have liked to have read every one of them. Alas! we are only a reviewer during our odd moments, and if we get through ten or a dozen works every full moon we are doing astonishingly well.

One evening not long ago we began our half hour reading prior to seeking our usual seven hours slumber, and selecting a book at random discovered it was THE DISCOVERY OF ETHER ANAESTHESIA by Frances Long Taylor, with a Foreword by Francis R. Packard. Eight excellent full-page plates are included in this tome of 237 pages, published by Paul B. Hoeber, Inc., New York. When we finished the last page we found we had read far into the night. Although we lost sleep we felt repaid by the fascinating account of a much debated subject by the authoress, the daughter of Dr. Crawford W. Long. Mrs. Taylor, we have been told, is a lady now past four score of years, living at Athens, Georgia. Only the other day we saw a letter she had occasion to write concerning some business and the penmanship was that of a girl in her early twenties.

In the Author's Note one reads, "This book has been written with the aim of presenting an absolutely truthful account of the life and work of Dr. Crawford Long . . . Upon investigation the author finds that on the first meeting (Georgia Medical Association, known as the Georgia State Medical Society) no formal business was transacted except the passing of a resolution that the Legislature be requested to pass a certain bill. The writer also finds that Dr. Long jointed this Society at a meeting in Savannah, April 1853, and at that occasion read a paper on his discovery of sulphuric ether as an anaesthetic."

Dr. Francis R. Packard in the Foreword says, in part, ". . . Although the facts bearing on the discovery of ether may be summed up in a few paragraphs and have long been clearly established, nevertheless from time to time echoes of the furious battle which it aroused are heard. There are two outstanding facts which emerge from the mass of statements, claims and contradictions bearing on the subject, i.e., Crawford W. Long was the first man to use ether for the purpose of producing surgical narcosis, and W. T. G. Morton was the first to demonstrate its use before a professional gathering . . . Long and Morton were the direct anthitheses of one another. Long's use of ether as an anaesthetic occurred in an accidental manner. Morton's discovery of ether was the result of a deliberate search for an agent to relieve pain during a surgical procedure. Long practiced in a small rural community where he had no opportunity to talk with professional colleagues, no hospital in which he could observe its effects on a number of cases . . . Morton made his discovery in one of the medical centers of the United States . . . Nevertheless between 1842 and October 16, 1846, when Morton etherized a patient at the Massachusetts General Hospital, Long had undoubtedly used ether many times as an anaesthetic.

"This little book which follows is the result of a lifetime of filial devotion. As a young woman Mrs. Taylor was intimately acquainted with all the details of her father's work. He was too modest and retiring a man to push his claims as vigorously as the other candidates for the honor of the discovery. While Morton and Jackson were clamoring for pecuniary rewards and personal fame, Long pursued his daily avocations and only ventured to issue a statement of what he had done without making any claim for recompense. Since his death his daughter has labored unceasingly to place his just claims in their true light . . . In the following narrative the reader will find a beautiful picture of a doctor of the old school whose life was passed in doing good deeds. . . ."

In the Introduction we learn "this little sketch" was not originally written for publication, but for Dr. Long's grandchildren. After the Introduction we are taken to a chapter devoted to Long's parentage, birth and education. The third chapter is devoted to his medical education and early practice, and

the following chapters to the first use of ether as an anaesthetic, publication of the results of the use of ether, the famous ether controversy, the Civil War, last years and death, and recognition.

A delightful book. A book every physician interested in the history and the culture of his profession will want to possess, keep on his shelves, and of an evening, when the day's *work* is finished take down, open and read for the sheer enjoyment resulting from the witchery of words.

Another worth while book is GYNECOLOGY FOR NURSES by Harry Sturgeon Crossen, M.D., F.A.C.S., Professor of Clinical Gynecology, Washington University Medical School, etc., with 365 engravings, including one color plate. It is published by the C. V. Mosby Company, St. Louis, 1927.

One can criticize the perfect if he tries hard enough, and we could pick flaws with parts of this book of 281 pages, but on the whole we would stamp Dr. Crossen's "Gynecology for Nurses" as an ideal work of its type. Not only will a study of its pages make for a better nurse but physicians might read it with profit. We object to photomicrographs and the technical steps of surgical procedures for nurses' reading, but these are far outbalanced by page after page of solid, necessary information. We would have every student and graduate nurse own a copy. If such a nurse were lazy and did not read the text carefully, a mere study of the many well-done illustrations would give her more useful knowledge of a practical nature than would hours of dry, canned lectures. The cost is $2.75. The part devoted to Preparation of Supplies, alone, is worth the cost of purchase.

Bound in the usual paper cover we picked up CANCER D' ESTOMAC by Victor Panchet and A. Hirchberg. There are 173 illustrations and it is published by Gaston Doin & Cie, Paris, 1928 The price is 45 francs.

When one contemplates this work, after reading it, he wishes the entire medical profession could read French. For the authors have done a thorough bit of work in an interesting manner. The illustrations are well executed and, in part, show the steps in the various operations. Besides a consideration of the technique of operations for the relief of cancer of the stomach, chapters are devoted to considerations of diagnosis, pathology, complications, etc., all illustrated showing gross specimens and microscopic sections. If one is

a surgeon and can make a little head and tail of scientific French, he should by all means own this book.

J. B. Lippincott Company (1927) have brought out another of their INTERNATIONAL CLINICS, a Quarterly of Illustrated Clinical Lectures and Especially Prepared Original Articles . . . by leading Members of the Profession Throughout the World. This book is of Volume III . . . Thirty-seventh Series.

Naturally the medical profession needs no introduction to these valuable contributions to medical literature. Volume III (311 pages) is composed of ten articles devoted to diagnosis and treatment, one article each on medicine, surgery, obstetrics, neurology, medical history, and two articles on post-graduate study. There are three colored plates and numerous illustrations and figures.

A work that should be welcome is POLIOMYELITIS with Especial Reference to the Treatment, By W. Russell MacAusland, M.D., Surgeon-in-Chief, Orthopedic Department, Carney Hospital, Boston, Mass. It is illustrated with 173 engravings and is published by Lea & Febiger, Philadelphia, 1927. The price is $5.50 net.

In the preface we read " . . . The greatest progress has been made in the methods of treatment, and particularly in the orthopedic field. Deformity can now be prevented in nearly every instance; the return of function can be hastened by proper treatment of the involved area; and, finally, by the use of surgical procedures, the wearing of cumbersome apparatus may be obviated in the majority of cases.

"From the voluminous material that has been published on poliomyelitis, the writer has tried to select the factors that are recognized as having definite value. In the epidemic and experimental field, in which much remains to be determined, the most recent investigations have been reported. From the large number of operative procedures that have been devised for paralytic conditions, the writer has selected those measures that have stood the test of time and can be accepted as standard."

MacAusland in his work lives up to his preface. In many cases the aftermath of this dread disease is horrible, and for a long time the treatment of complications following in the wake of the acute condition was in a chaotic state.

MacAusland has done an admirable piece of work. Internists, surgeons and orthopedists are hereby advised to buy this book.

A typically French surgical work, one of a series, is recommended to all general surgeons. It is LA PRATIQUE CHIRURGICALE ILLUSTREÉ by Victor Pauchet (Fascicule VI). It is 274 pages and has 275 illustrations by S. Pupret. The publishers are Gaston Doin & Cie, Paris, 1927. The price is 55 francs.

If one reads French he has a delightful time ahead of him and is sure to profit from a consideration of the text. If one does not read French he may profit by observing the wonderful illustrations, which are easily understood. The following topics comprise the volume:

Traitement du Xanthclasma.

Ulcus pénétrants de l'estomac et du duodenum.

Exploration de la region pyloro-duodénale.

Anus coecal dans l'obstruction intestinale par cancer colique.

Traitement du cancer du colon (angle hepatique).

Hernie crurale gangrénée.

Les diverticules de la vessie.

La Splenectomie.

While we are on the subject of foreign medical books we wish to draw the reader's attention to two German works. The first is DIE BLUT-TRANSFUSION by Dr. E. Kubányi, with a foreword by Professor Dr. L. V. Bakay. It is published by Urban & Schwarzenberg, Berlin, 1928. The price is 6 marks.

The author has covered the broad field of transfusion in a comprehensive and thorough fashion. Nothing has been left unsaid. But much of the text seems unnecessary in view of the fact the procedure has become a commonplace. One may almost assert that a homo medico cannot aspire to immortality in the surgical realm unless he has devised and has called after his name a blood-transfusion apparatus.

To the student and anyone interested in everything ever written on the subject this work will appeal, for the bibliography is complete as is shown by the fact it covers 24 pages of finely printed text.

The other German work is DER FREI-BENDE UTERUS—in operations—anatomischer Darstelling . . . by Wilhelm Liepmann. The Berlin firm of Urban & Schuarzenberg, 1927, are the publishers. The price is 18 marks.

This excellent atlas, if one may so term it, is of great interest to the obstetrician. It is in length but 43 pages, but the pages are very large. Following a foreword and an anatomy of postmortem findings of the post-partum uterus, with 6 illustrations, there are 8 tabules, consisting of enlarged illustrations on one page and on the opposite page the legend in detail. The art work is in black and white. To anyone interested in obstetrics this brief work is recommended.

We are nearing the end of our alloted space and will use it to recommend a few very worth while books. The general practitioner and internist will be intrigued by T. Stacy Wilson's TONIC HARDENING OF THE COLON. It is published by Oxford University Press. A sane, interesting discussion of the colon and its diseases and the symptoms resulting thereby written from a new angle, the whole chock full of meaty facts.

CANCER CONTROL . . . Lake Mohonk Conference, 1926. Report of An International Symposium Held under the Auspices of the American Society for the Control of Cancer, published by The Surgical Publishing Company of Chicago. If particularly interested in the many phases of this subject you will want this book.

HYGIENE UND DIATETIK DER FRAU by Dr. med. Hugo Sellheim, with 193 illustrations, published in München by Verlag von J. F. Bergmann. Splendid book. It is worth while for someone to translate it into English. A book every general practitioner could read with profit . . . that is, if he reads German. Otherwise, it would be a dead loss, except that the pictures are interesting.

DIE CHIRURGIE DER LUNGENERKRANKUNGEN by Prof. Dr. W. Jehn with 68 illustrations and 15 color plates.

DIE CHIRURGIE DES BRUSTKORBES by Prof. Dr. A. Schubert, with 35 illustrations and 11 color plates.

This is one of a series of surgical monographs. To the student of German they will prove valuable. Any surgeon who is interested and who does thoracic surgery should get this book (price 19 marks) for the illustrations and colored plates, if for no other reason. The authors have been most thorough and conservative and the net result is a work of remarkable merit.

We still have a high pile of books . . . many of them you will want to own . . . and we would like to say a few words about every one of them . . . but enough for this time. Next month we will begin where we now leave off.

BOOKS RECEIVED

UROLOGY. By William F. Braasch, M.D., F.A.C.S., Head of Sect. on Urology, Mayo Clinic; Prof. of Urology, Mayo Foundation for Med. Education & Research, Graduate School, Univ. of Minnesota. In collaboration with Benjamin H. Hager, B.S., M.D., Assoc., Sect. on Urology, Mayo Clinic. Ed. 2. 8vo. Cloth. Pp. 480, 759 roentgenograms. Phila. W. B. Saunders Co., 1927.

THE EFFECT OF HEAT UPON RAT-TUMORS. By Nils Westermark. Sonderabdruck aus *Skandinav. Arch. f. Physiol.*, vol. lii. Berlin. Walter de Gruyter & Co., 1927.

THE CURRENT SIGNIFICANCE OF THE WORD ALUM. By William D. Richardson, Former Ed., *Industrial Engineering Chem.;* etc. 8vo. Cloth. Pp. 93. Chicago: Commonwealth Press, 1927.

ATLAS DER HISTOTOPOGRAPHIE, GESUNDER UND ERKRANKER ORGANE. By Erwin Christeller, Direktor der Pathologish Anatomischen Abteilung des Stadtischen Rudolf Virchow Krankenhauses in Berlin. Folio, Cloth. 182 photo on 88 pl., 4 text illus. Leipzig: Georg Thieme, 1927.

DIE LAGERUNG VERLETZTER UND ERKRANKTER GLIEDMASSEN LEERSCHIENEN UND VERBANDLOSE WUNDBEHANDLUNG. By Geh. Med. Rat. Prof. Dr. Heinrich Braun, Zwickau. 8vo. Paper. Pp. 118, 101 Illus. Leipzig: Barth, 1928.

EPIDEMIC ENCEPHALITIS (ENCEPHALO-MYELITIS). By Leo M. Crafts, M.D., Formerly Dean and Prof. of Nervous and Mental Dis., Med. Dept., Hamlin Univ. 8vo. Cloth. Pp. 237, Illus. Bost. Richard G. Badger, 1928.

TREATMENT OF OSTEOLYELITIS AND OTHER INFECTED WOUNDS. By H. Winnett Orr. Cloth. Pp. 54. Repr. from Surgeon General's Office.

PERCIVAL'S MEDICAL ETHICS. Ed. by Chauncey D. Leake. 8vo. Cloth. Pp. 289. Balt. Williams & Wilkins Co., 1928.

DIAGNOSIS AND TREATMENT IN DISEASES OF THE LUNGS. By Frank E. Tylecote, M.D., D.P.H., F.R.C.P., Hon. Phys., Manchester Royal Inf.; Lect. in Clin. Med., Victoria Univ. of Manchester; and George Fletcher, M.A., M.D., M.R.C.P., D.P.H., Ass't. Tuberculosis Officer, Lancashire County Council. 8vo. Cloth. Pp. 270. London. Humphrey Milford, Oxford University Press, 1927.

CLINICAL RESEARCHES IN ACUTE ABDOMINAL DISEASES. By Zachary Cope, M.D., M.S., F.R.C.S., Senior Surg. to Out-Patients, St. Mary's Hosp., Paddington; Senior Surg., Bollingbroke Hosp., Wandsworth Common; Hunterian Prof. & Sometimes Arris & Gale Lecturer, R.C.S. Ed. 2. 8vo. Cloth. Pp. 214. Humphrey Milford, Oxford University Press, 1927.

THE PNEUMOTHORAX AND SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS. By Clive Rivers, M.D., F.R.C.P., Phys., City of London Hosp. for Diseases of Heart and Lungs; Phys., East London Hosp. for Children. 8vo. Cloth. Pp. 311. Humphrey Milford, Oxford University Press, 1927.

BACTERIOLOGY AND SURGERY OF CHRONIC ARTHRITIS AND RHEUMATISM WITH END RESULTS OF TREATMENT. By H. Warren Crowe, M.D., B. CH. M.R.C.S., L.R.C.P. Chapter on Surgical Treatment by Herbert Frankling, C.B.E., M.R.C.S. 4vo. Cloth. Pp. 187. Humphrey Milford, Oxford University Press, 1927.

PATHOLOGICAL PHYSIOLOGY OF INTERNAL DISEASES. By Albion Walter Hewlett. 8vo. Cloth. Pp. 787, 164 Illus. N. Y. D. Appleton & Co., 1928.

GYNECOLOGY. By Howard A. Kelly, A.B., M.D., LL.D. 8vo. Cloth. Pp. 1042. N. Y. D. Appleton & Co., 1928.

KURZE GESCHICHTE DER CHIRURGIE. By W. von Brunn, Prof. f. Geschichte der Medizin a. d. Univ. Rostock. 8vo. Paper. Pp. 339, 317 Illus. Berl. Julius Springer, 1928.

THE SURGEON'S MARKET PLACE

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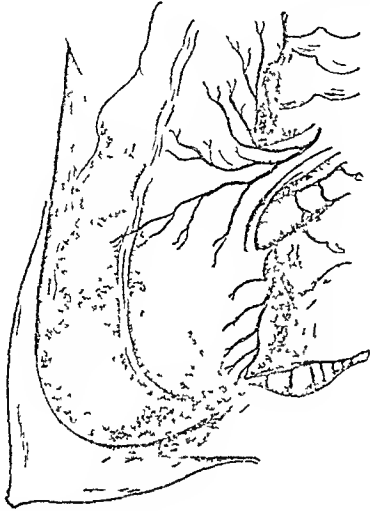
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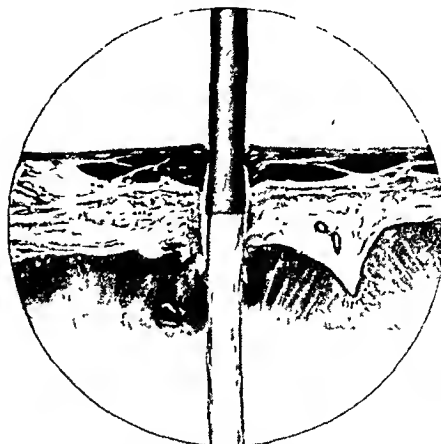
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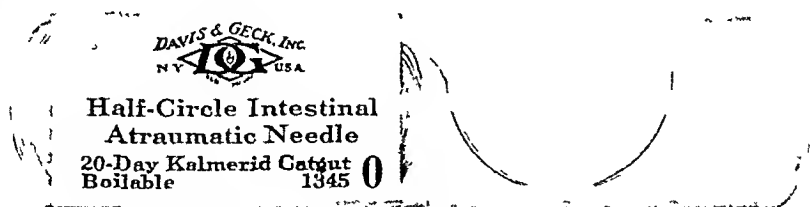
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CONTENTS—MARCH, 1928

ORIGINAL ARTICLES

The American Journal of Surgery

CONTENTS—MARCH, 1928

Continued from page i

General Information page iv
Index to Advertisers page xviii

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HORMOTONE

in disorders of

MENSTRUATION

and the

MENOPAUSE

IN a meeting of the Section of Obstetrics and Gynecology of the Royal Society of Medicine, June 7, 1923, a paper was presented by Leonard Phillips, M.S., M.B., B.Sc. Lond., F.R.C.S. Eng., on the treatment of 100 cases of dysmenorrhea. He said, "50 cases were treated by organo-therapy . . . . The majority were treated with Hormotone . . . . 46 of the 50 cases so treated were relieved."

MENSTRUATION is regulated by the internal secretions and its disorders require internal secretion therapy. Hormotone is composed of the substances of those endocrine glands which control the menstruation process—thyroid, pituitary, adrenal and gonads.

AMENORRHEA, DYSMENORRHEA AND MENORRHAGIA ARE USUALLY
SUSCEPTIBLE OF RELIEF AND FREQUENTLY OF CURE

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SURGERY OF THE

LARGE INTESTINE*

EUGENE H. POOL, M.D. AND FRANK J. McGOWAN, M.D.

NEW YORK

PROPER functional activity of the colon is of vital importance from the standpoint of health. Deviation from the normal is registered most often by constipation, and colicy pains along the course of the large bowel, especially in the region of the caecum, but attacks of diarrhoea may be the dominating feature. Such functional derangements usually stimulate efforts to explain the trouble by some definite lesion of an inflammatory neoplastic or mechanical nature which can be corrected by surgical measures. In consequence, chronic constipation and pains in the right iliac fossa often lead to unnecessary operations, with removal of a so-called chronic appendix, repair of an incompetent ileocaecal valve, plication of a redundant or distended caecum; freeing of kinks or bands, side tracking as ileosigmoidostomy, and even resection of the colon. Unfortunately the symptoms usually persist after such procedures, which are in general ill directed efforts to correct chronic constipation and its associated disturbances by the short cut of surgery.

We are not criticizing thorough and early study of a case; this is essential. We are condemning operations which are not indicated, and these are most frequently done in this region.

Removal of the appendix is of course indicated when symptoms have occurred suggesting disease of the organ, but the other procedures are rarely indicated.

Before even the relatively innocuous operation of appendectomy is undertaken a careful study should be made lest tuberculosis or carcinoma of the colon, inflammation of Meckel's diverticulum, a ureteral stone, disease of the gall bladder or duodenal ulcer—the real cause of the symptoms —be overlooked and discovered later. (Fig. 32.)

This is not of infrequent record. Moreover, it must be remembered that the caecum and appendix occasionally are not situated in the right iliac fossa. It is wise, therefore, in chronic cases especially in children to determine this feature by roentgenogram before operation is undertaken. I recently had a case which illustrates this. The patient was a young boy in whom an intermuscular incision failed to reveal the caecum and appendix, which lay in the left lower quadrant. The cause of such abnormal situation may be complete transposition of viscera, non-rotation, nondescent or long mesocolon. The anomaly must be borne in mind. (Figs. 1 and 2.)

The foregoing is intended, to discourage ill advised and meddlesome surgery; to stimulate full study of a case; and to urge the analysis of all possibilities of differential diagnosis before operation is undertaken.

Most of the lesions of the large intestine, not including the rectum, are situated in

* Read at a meeting of the College of Surgeons, Detroit, November, 1927.

FIG. 1. Female, eighteen years. Pain in right lower quadrant with nausea and constipation for three days. Left sided appendix. Barium enema showing large intestine on the left side.

FIG. 2. Same as preceding case. Barium enema after evacuation.

FIG. 3. Intestinal obstruction low in ileum showing distended loops.

FIG. 4. Female, forty-four years. For past three or four years has had attacks of nausea and vomiting every two or three months and lasting several days. For one year has had occasional dull pains across lower abdomen. During last attack, three weeks before admission, noticed a painless mass in right lower quadrant. Bowels constipated but normal in character. Physical examination: Well developed and nourished, not appearing ill. Over region of cecum there is a firm, somewhat tender and slightly movable mass 10 × 10 em. Barium enema shows small filling defect in cecum. At operation an ileocolostomy with resection of caecum, terminal ileum and ascending colon was done for hyperplastic tuberculosis of cecum. Postoperative course smooth. Health excellent to date.

the caecum and must be considered as possibilities in the study of the average chronic case presenting abdominal symptoms. Moreover there is a close similarity of their symptoms. We will therefore first discuss these lesions.

TUBERCULOSIS

Localized tuberculosis of the colon is of more frequent incidence than is usually supposed. Far too often it goes unrecognized. The most frequent sites are the caecum and ascending colon though any part may be affected. While several types of lesions occur, the most significant for the surgeon is the hyperplastic. This is a slow chronic development with marked thickening of the intestinal wall and relatively little ulceration. In general, symptoms develop only when the lumen or the peristalsis of the bowel are affected. The symptoms therefore suggest chronic intestinal obstruction: slowly developing constipation, with periods of diarrhoea, at times with evidence of blood in the stools, colicy pains, local tenderness and ultimately a palpable mass. The general condition of the patient, and evidence of tuberculosis elsewhere are suggestive; while roentgenogram following a barium enema sometimes clinches the diagnosis. The characteristic filling defect of hypertrophic tuberculosis is a complete absence of barium at the site of the lesion; in this respect it differs from that noted in carcinoma. Yet in many cases the two conditions cannot be differentiated in roentgenogram studies. Other lesions than carcinoma also may be difficult to differentiate, even at operation, as inflammatory changes arising from the appendix, or actinomycosis.

When the process has led to stenosis with symptoms of chronic intestinal obstruction operative relief is indicated. When the lesion cannot be differentiated from carcinoma the treatment should be the same as for cancer.

In general, however, tuberculosis of the colon should be treated conservatively.

It has been shown, notably by Lawrason Brown,[1] that intestinal tuberculosis can heal completely. Analysis of results in cases treated by surgery and heliotherapy demonstrates that heliotherapy offers by far the better prospects of cure. The treatment must be continued intensively under expert direction for many months. Artificial heliotherapy is less efficient than the direct rays of the sun. The prognosis depends largely upon the extent of associ-

Fig. 5. Male, twenty-two years. In April, 1923, incision and drainage of appendiceal abscess. Following operation had persistent sinus. In November, 1923, sinus was excised and appendix removed. Subsequently complained of constipation and dull "aching" pains in left lower quadrant; patient noticed a small hard mass beneath abdominal wall in left lower quadrant. Operation, February, 1924. Extraperitoneal; mass consisted of a firm wall enclosing a cavity extending into pelvis, containing yellowish granular material in which actinomycosis was demonstrated. Ultimately died.

ated lesions, notably pulmonary. (See Figs. 4, 37, 38.)

ACTINOMYCOSIS

Actinomycosis, a microorganism of the fungus variety rather widely distributed in certain grains or other vegetable prod-
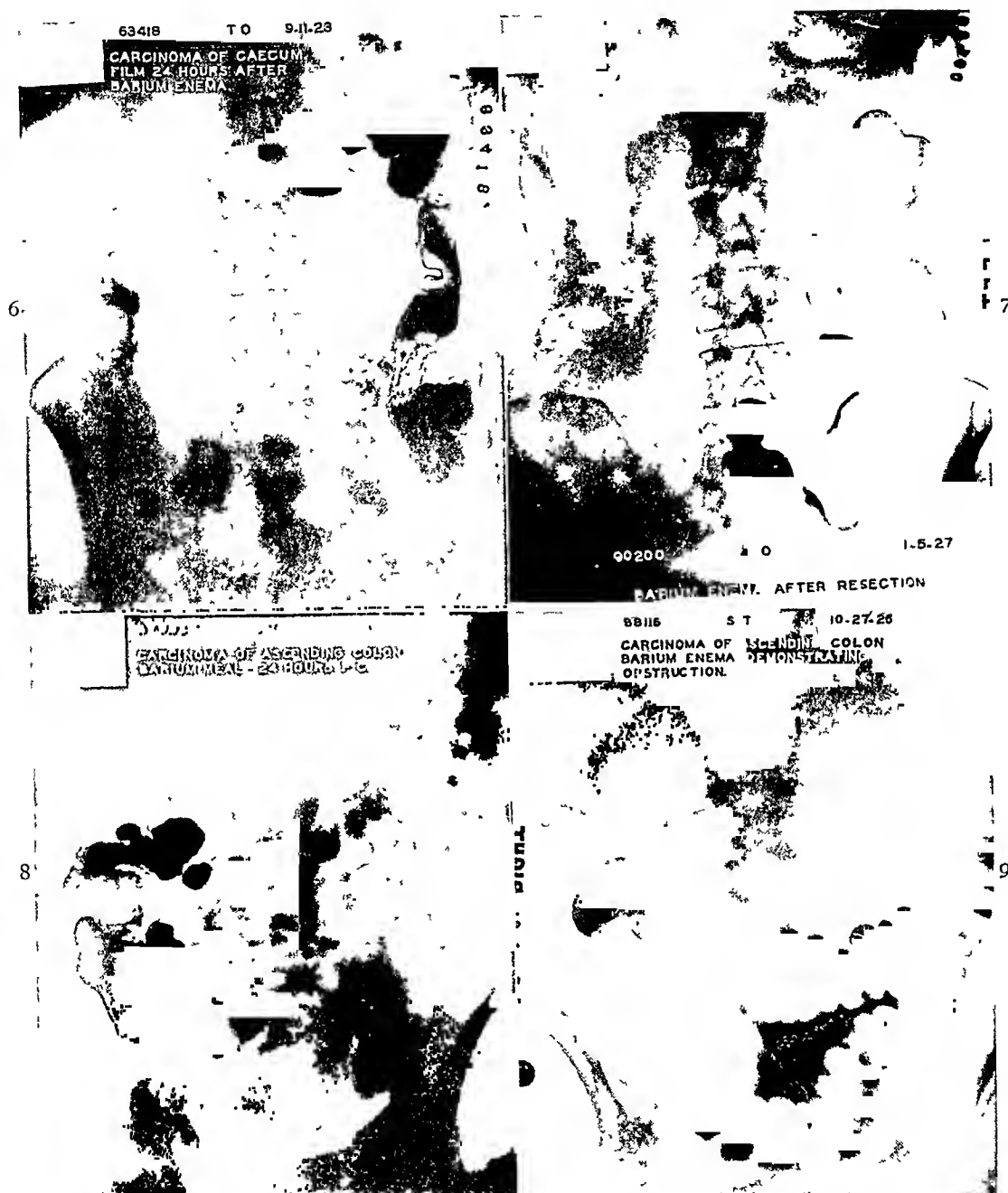
FIG. 6. Female, forty-three years. Six months prior to admission had an appendectomy for acute appendicitis. One month prior to admission began to have attacks of severe cramp-like pains around umbilicus, associated with vomiting. Admitted during an attack and diagnosed acute intestinal obstruction of mechanical origin. Operation revealed a carcinoma of ascending colon. An ileosigmoidostomy was performed and two weeks later resection done. Pathology: adenocarcinoma of colon with metastases in regional lymph-nodes. Postoperative course smooth Health to date, four and a half years later, excellent.

FIG. 7. Same as preceding. Enema after resection and anastomosis.

FIG. 8. Male, sixty years. For past three months had constipation and pains in right lower quadrant. No blood in stools. Loss of eighteen pounds in weight with increasing weakness. At operation an extensive carcinoma of ascending colon was resected. The regional lymph-nodes were involved. Postoperative course smooth. Developed metastases and died eight months later.

FIG. 9. Same as preceding case. Barium enema.

FIG. 10. Female, thirty-three years. Two months before admission she suddenly developed acute pains in right lower quadrant which radiated to right shoulder. This attack was associated with nausea and vomiting for ten days. Two more similar attacks have occurred. Has lost thirty pounds in weight. Physical examination, essentially negative save for slight tenderness and resistance in right lower quadrant. At operation a large adenocarcinoma of caecum was resected. Smooth course. Health excellent past four years.

FIG. 11. Same as preceding case, after ileocolostomy and resection of right colon.

FIG. 12. Male, sixty-one years. Increasing weakness for three months. Slight afternoon fever. Anorexia and constipation. Mucus and blood found in stools. Physical examination, negative. Barium enema failed to reveal lesion. See Figure 13.

FIG. 13. Same case as preceding. Extensive infiltrating carcinoma of hepatic flexure. Opaque transverse colon displaced mesially disclosing lesion. Note that lesion was recognized only after manipulation of transverse colon. This was done under fluroscope with a wooden spoon. Operation: three-stage Mikulicz. Following third stage patient developed a suppurative thrombophlebitis of iliac veins, and died.
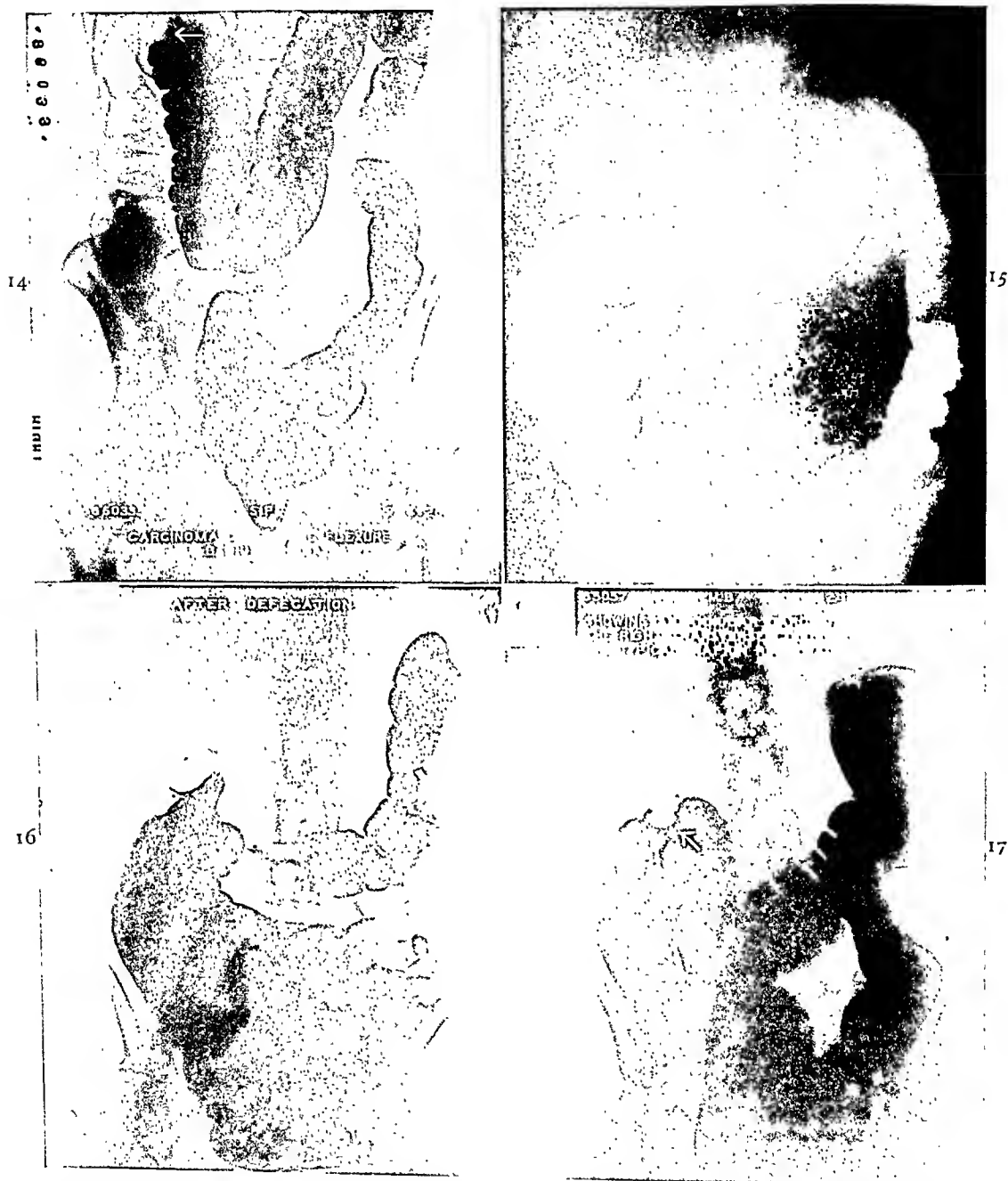
FIG. 14. Female, forty-one years. Pain in umbilical region for three months. Increasing constipation, weakness and loss of 15 pounds in weight. No melena. Operation: resection for carcinoma of hepatic flexure. Pathology: extensive carcinoma of colon infiltrating mesentery. Postoperative course smooth. Developed liver and peritoneal metastases and died nine months later.

FIG. 15. Carcinoma of transverse colon, showing dilatation of proximal bowel.

FIG. 16. Female, thirty-nine years. Increasing weakness, eructation of gas for three months. Pallor, cachexia and blood in stools. Roentgenogram shows carcinoma of transverse colon with filling defect. Operation: resection. Postoperative course smooth. Ultimately died as result of metastases.

FIG. 17. Carcinoma of hepatic flexure. Note "napkin ring" deformity.

Fig. 18. Carcinoma of splenic flexure.

Fig 19. Male, thirty-two years. Began to have attacks of colicy pain below left costal margin one year before admission. Then a free interval for eight months. Then attacks occurred every two or three days. Severity of attacks were in direct relation to constipation. Twice noticed blood in stools. Increasing constipation with "pencil" stools. Examination showed a firm, nodular mass invading colon and mesentery. Inoperable. Caecostomy performed. Postoperative course smooth. Ultimately died.

ucts, occasionally reaches the tissues from the intestinal tract. It grows in characteristic fashion as colonies of yellowish granules presenting under the microscope radiating filaments. The ileocaecal region is the usual site. A slow chronic inflammatory reaction causes marked thickening of the intestinal wall, the adjacent tissues later becoming involved in the process which ultimately invades the abdominal wall and retroperitoneal tissues. The skin breaks down and tortuous fistulae with boardlike induration of the adjacent soft parts develop. In the scant pus the fungus may be recognized.

Two features must be noted: (1) In the early stages the lesion may readily be mistaken for carcinoma, hyperplastic tuberculosis, or chronic inflammation dependent upon the appendix. The true nature of the lesion cannot be recognized at operation. Under these conditions resection is appropriate. (2) Later, when fistulae and extensive infiltration have occurred, radical operation is useless. It simply opens up new areas for infection. (Fig. 5.)

CARCINOMA

The colon is a frequent and relatively favorable site of cancer. Favorable, because

Fig. 20. Female, fifty years. Pain in left lower quadrant and increasing constipation for eight months. Occasionally has distension with audible gurgling. Patient was pale but well nourished. In left lower quadrant there was a firm, tender, freely movable mass. At operation the descending colon was found incorporated in a large, stony, hard mass. There were peritoneal metastases. This is shown to illustrate how an extensive carcinoma may not be noted by roentgenography.

the neoplasm ordinarily is limited in extent, slow in growth and late in metastasizing. Moreover metastases are for a long time confined to the regional lymph-nodes and these can be excised with the growth. While various histological types of cancer occur in the colon and differ in their malignancy, exception to the above characteristics are infrequent. Unfortunately the advantage offered by the slowness of growth is often sacrificed by late recogni-

FIG. 21. Female, thirty-six years. Patient suddenly developed acute intestinal obstruction which was relieved by caecostomy. Later an exploration was done. Carcinoma of splenic flexure found and an ileosigmoidostomy performed. At a third stage a resection from caecum to descending colon inclusive was done. Pathology: adenocarcinoma of intestine at splenic flexure extensively infiltrating the wall. Postoperative course smooth. Health excellent eighteen months later.

tion of the lesion. Cases are often not recognized until a mass is palpated or signs of intestinal obstruction are present. Yet there are usually suggestive clinical features which should lead to investigation, correct diagnosis and relatively early surgery. These are blood in the stools, abdominal discomfort and derangement of the bowels.

Blood in the stools due to ulceration of the growth always occurs at some time in the course of the disease and often occurs early, even as the first symptom. It should immediately lead to persistent investigation until the cause of the bleeding is demonstrated. Careful rectal and sigmoidoscopic examinations and roentgenogram studies are indicated. It must be admitted that occasionally bleeding from the bowel occurs which is impossible to explain, for instance, in certain cases of purpura, but one can and should settle the question whether or not cancer is the cause.

Pain or discomfort of a colicy nature with irregularity of the bowels may be the first complaint. The situation of the growth modifies these symptoms. The sigmoid is the most frequent site, then the caecum, then the ascending colon. In cancer of the right half of the colon, diarrhoea usually occurs for a time, whereas progressive constipation is associated with cancer of the left colon. This difference is due to the same factors as render obstruction far less constant in cancer of the right colon than in other parts of the large bowel. Early anemia is the rule and may be quite marked especially in cancer of the right colon. It is due to the persistent though slight bleeding from the ulcerated area.

While cancer here as elsewhere develops most often in advanced life, it must not be supposed that youth is immune; not infrequently it occurs as early as the third decade of life. It is more frequent in men than in women.

As the growth advances the lumen of the bowel becomes constricted and chronic or acute obstruction results. This is almost always the case in growths of the splenic and descending colons, but is less constant in those of the caecum and ascending by reason of the large diameter of this part of the colon, their fluid contents and the fact that the annular or napkin ring carcinoma is less frequent in these parts than elsewhere. The bowel above the obstruction distends and its vitality ultimately becomes impaired.

The diagnosis of carcinoma of the colon can usually be readily made by roentgenogram following a barium meal or enema. In some situations, as the hepatic and splenic flexures and particularly the pelvic colon an adjacent portion of the colon may obscure the lesion. Therefore in order to demonstrate the lesion in some cases fluoroscopy, barium meal and barium enema may all have to be employed and even manipulation of the adjacent bowel

early studies may be made. The trouble is that we are too prone to jump at some other diagnosis and not weigh all the possibilities.

We have had three cases—one in the caecum, one in the ascending and one in transverse colon—in which cancer was not suspected before operation, the diagnosis being respectively, duodenal ulcer, cholelithiasis and chronic appendicitis. In all of these roentgenogram of the lower
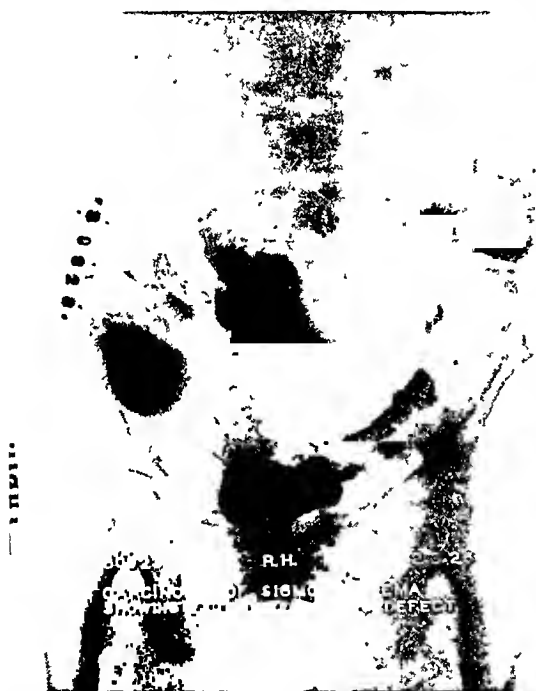
FIG. 22. Female, forty-eight years. Perfectly well up to six weeks before admission. Then abdomen became distended, bowels irregular with streaks of blood in the stools. Progressive weakness. Patient cachectic with palpable mass in umbilical region. No operation. Autopsy showed carcinoma of sigmoid with multiple metastases in liver and in lungs. Colon also showed multiple polyposis.

FIG. 23. Carcinoma of sigmoid. Showing distention of colon from chronic intestinal obstruction. Barium enema.

during investigation. One of our cases of cancer of the hepatic flexure illustrates this feature. (See Figs. 12 and 13.)

In the pelvic colon the overhanging intestine often completely obscures the lesion in the roentgenogram; consequently sigmoidoscopy may demonstrate the growth even better than roentgenography. It is important that the possibility of cancer be considered in all cases presenting bleeding or indefinite abdominal symptoms so that

bowel should have resulted in a correct diagnosis.

In this connection it is important to emphasize two general details of diagnosis; first, the importance of a routine rectal and sigmoidoscopic examination; second, the danger of administering barium by mouth in cases of suspected obstruction. This may convert chronic into an acute obstruction and may cause an accumulation of barium above the obstruction which may be disadvantageous if resection is undertaken. In acute cases roentgenogram without barium will often show loops

distended with gas and indicate the position of the lesion. (Fig. 3.)

Before obstruction develops resection is the rule. In the right half this should be done in one stage. The intestinal contents are fluid and probably less infectious, both features being favorable to immediate anastomosis. Side to side anastomosis is the safest in most hands and gives good ultimate results.[2] In the left half the two

anastomosis and the toxemia resulting from the obstruction renders the patient intolerant of prolonged operation. Radical resection may be done at a later stage.

The important features are: (1) Early operation. In doubtful cases an exploratory operation is indicated. (2) Early recognition of obstruction. The condition of the patient becomes rapidly worse and is often far more serious than appears to be
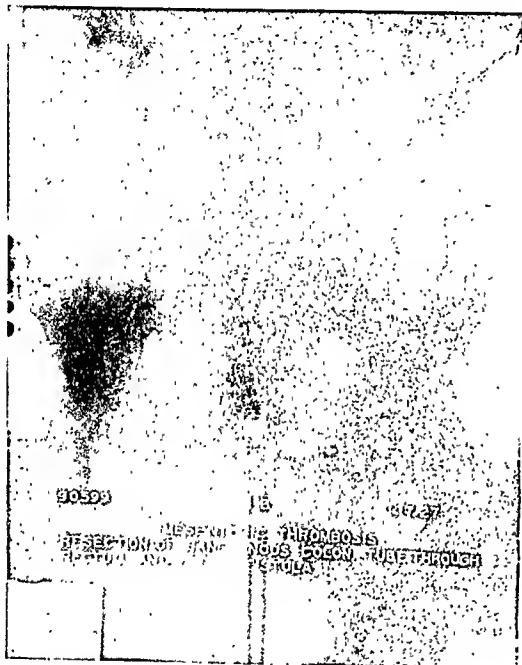
FIG. 24. Male, twenty-six years. Sudden onset of severe intermittent pain in left abdomen. Bowels regular. On second day after admission patient's abdomen became greatly distended with generalized tenderness and rigidity. Prostration was marked. Laparotomy performed under local anaesthesia. An enormously dilated sigmoid (six inches in diameter) gangrenous throughout was found. The distal limb was gangrenous down to rectum. Three stage Mikuliez performed. After slough had separated, tube was passed per rectum and attached to upper limb of descending colon and persistent traction exerted. The upper loop was gradually brought downward toward lower loop of rectum completely bridging the gap. Then the last stage, a closure of fecal fistula, was done with uneventful convalescence. Health now excellent.

FIG. 25. Same case as preceding. Mesenteric thrombosis. Barium meal at twenty-four hours. Shows how upper segment has been pulled down completely bridging gap and completing continuity of the bowel.

stage (Mikulicz) operation is infinitely safer and should be the operation of choice.

In acute obstruction a palliative procedure should always be elected, i.e. drainage of the bowel above the obstruction. The diseased bowel is not favorable for an

the case. (3) Relief of the retention is paramount to relief of the obstruction. Little time should be spent in seeking the cause. If this is not immediately found the distended bowel should be drained. Subsequently the cause may be determined and treated. (Fig. 21.)

In chronic cases, the cause may be investigated more thoroughly before operation.

While carcinoma is the most frequent cause of obstruction of the colon, other lesions must be considered as possibilities in any case presenting either acute or chronic symptoms. Of these, attention

must be called to inflammatory bands or adhesions, hypertrophic tuberculosis intussusception, volvulus, and mesenteric obstruction. (Figs. 6 to 23 inclusive.)

FIG. 26. Hirschsprung's disease (Cole's case).

INTUSSUSCEPTION

Intussusception, the invagination of one portion of the intestine into another, occurs most frequently in infancy and is the most common cause of acute intestinal obstruction at that age.

The condition originates in some thickening of the bowel wall, prolapse or polyp which projects into the lumen and like a foreign body excites peristaltic contractions. It is thus carried forward causing progressively increasing invagination of the bowel. The ileum into caecum is by far the most frequent type.

The clinical picture is striking and the symptoms characteristic. A healthy child, usually between six and twelve months

old, suddenly becomes seriously ill suffering with abdominal pain and vomiting. The pain is severe, colicy and intermittent. Between the attacks the child is quiet and
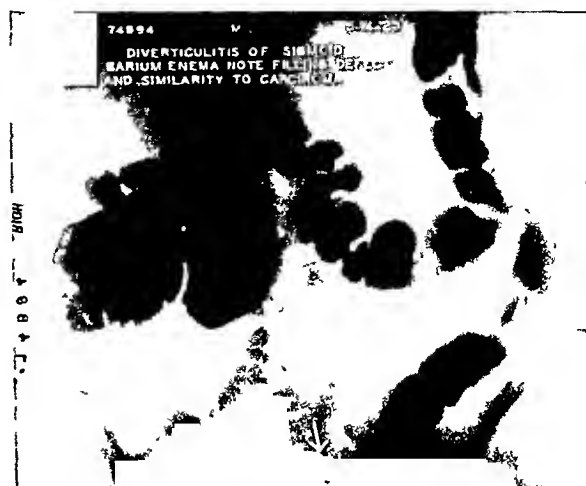
FIG. 27. Female, fifty-three years. Obese woman. For one month had persistent diarrhea, slight abdominal pain and occasional chills. At operation for suspected carcinoma, a mass enclosing necrotic tissue and pus was found to the left of the sigmoid mass drained. Smooth course. Health good two and a half years later.
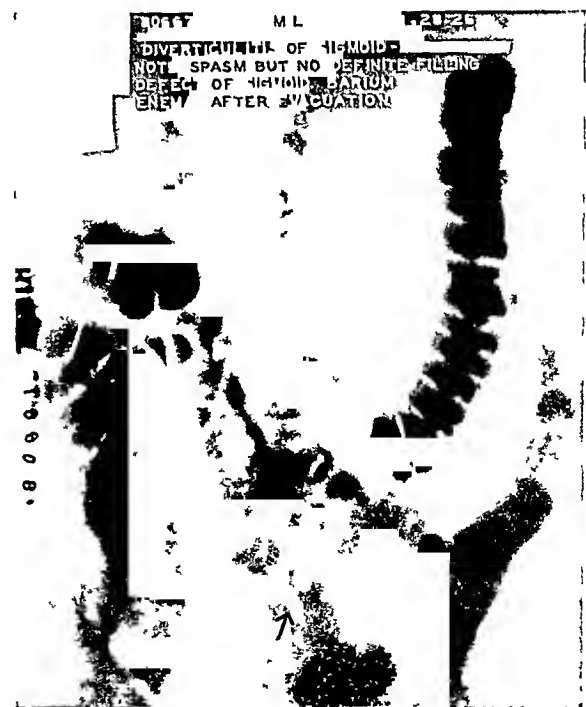
FIG. 28. Same as preceding case, six months later.

exhausted. Vomiting occurs early, first stomach contents, then bile and finally fecal-like fluid. After the lower bowel is

FIG. 29 Forty-eight hours after barium meal Diverticulitis of descending colon.

FIG. 30. Male, sixty-seven years For past year has complained of progressive weakness, loss of weight and strength. Diverticulitis

FIG. 31. Diverticulitis of sigmoid with retained barium

FIG. 32. Girl, fifteen years For five weeks patient has had abdominal pain associated with slight rise in temperature and leucocytosis Gradual loss of weight and strength. Operation revealed a gangrenous Meckel's diverticulum with abscess at tip adherent to the caecum. Appendix and diverticulum removed. Drainage. Smooth course. Result good.

evacuated, only blood and mucus are passed. Between the attacks of colic the abdomen is relaxed and a sausage shaped tumor can usually be felt in the abdomen even a few hours after the onset. It is not always in the right iliac fossa. The invaginated bowel may also be palpable by rectum.

Early laparotomy is essential. The patient should be carefully guarded from shock by warmth, clyses, etc. In early

blood in the stools and indefinite abdominal symptoms often precede the onset of the serious symptoms of intestinal obstruction by several days. If operation is performed during this period, resection may be successful; later the condition is usually fatal. (Figs. 24 and 25.)

Volvulus consists in torsion of an intestinal loop usually the sigmoid and most often occurs with idiopathic megacolon, as described by Hirschsprung.
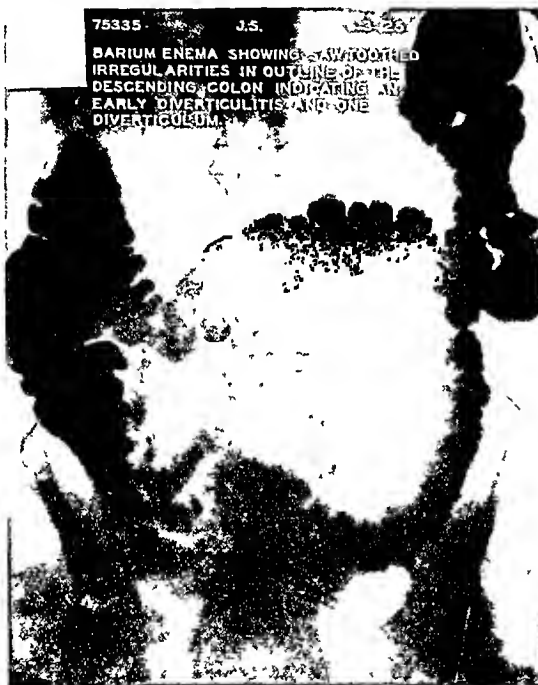
FIG. 33. Early diverticulitis of descending colon.
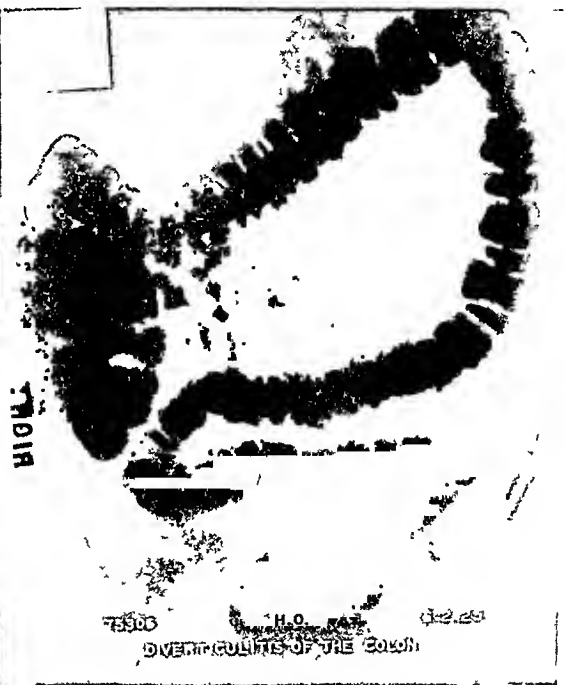
FIG. 34. Diverticulitis.

cases[3] it is usually possible to reduce the intussusception, great gentleness being observed. Later, resection is necessary. The important factors are early diagnosis and early operation.

MESENTERIC OBSTRUCTION

Mesenteric obstruction occasionally occurs in the colon and is due either to embolus from a heart valve or thrombosis of a mesenteric vein. A partial form has been described by Klein[4] in which function, that is peristalsis, is affected without interference with the vitality of the bowel. We have had one case which could be explained only in this way. Diarrhea with

The rotation produces intestinal obstruction. The symptoms demand immediate operation. Correction of the torsion, detorsion, is often sufficient. Some authorities also recommend fixation of the bowel to the abdominal wall to prevent recurrence. If the bowel is enormously dilated it may be necessary to aspirate its contents and possibly do a colostomy. If its vitality is affected multiple stage resection may be necessary.

HIRSCHSPRUNG'S DISEASE

In about two-thirds of the cases of Hirschsprung's Disease all of the colon is involved, in the others the dilatation is

FIG. 35. Male, sixty years. Persistent diarrhea for twenty-five years with three to six liquid stools a day. At times considerable mucus and blood in stools. January, 1926, caecostomy done and colon irrigated. No improvement. Later, exploration. Colon markedly thickened and contained small nodules. Ileosigmoidostomy performed. Condition improved. (Hitzrot's case.)

FIG. 36. Same as preceding case. Enema shows improvement after ileosigmoidostomy.

FIG. 37. Male, twenty-six years. Sudden onset of generalized abdominal pain three weeks before admission associated with diarrhea and loss of thirty-three pounds in weight. No blood in stools. Patient poorly nourished and acutely ill. Signs at lung apices and sputum positive for tubercle bacilli. Abdomen generally tender. Treated conservatively and improved.

FIG. 38. Same as preceding case. After irrigations and heliotherapy.

confined to the pelvic colon. The cause is obscure. The dilated colon causes kinking at its junction with the undilated lower portion resulting in accumulation of feces, gradual dilatation and hypertrophy of the intestinal wall and finally complete loss of peristalsis.

The significant symptoms are marked constipation from infancy, and distention of the abdomen. The roentgenogram gives a characteristic picture. As a rule the condition becomes progressively worse and death occurs during childhood from some intercurrent infection.

In treatment irrigation of the bowel should be systematically done. If this is not sufficient a caecostomy may be resorted to. Resection however is the best procedure. This may be done in one stage in a good risk, especially if the bowel can be emptied; otherwise, a two stage resection is preferable. (Fig. 26.)

DIVERTICULITIS

Diverticulitis of the colon has in recent years come to occupy an important place in abdominal surgery. The small sacculations or outward projections of the intestinal mucosa are usually multiple and may occur in any part of the colon. The sigmoid however is by far the most frequent site. As a rule, diverticula do not give rise to symptoms, the patient is not even aware of their existence. Their significance is due entirely to the fact that occasionally an inflammatory reaction occurs, probably excited by retention of intestinal contents. While the inflammatory changes simulate those which occur in the appendix vermiformis there is one very important difference. The diverticulum is short, its blood supply is not so readily arrested, necrosis and perforation are therefore slow; the diverticulum moreover is separated from the peritoneal cavity by a layer of fat of variable thickness. The inflammatory process advances less rapidly and walling off with abscess formation is the rule, diffuse peritonitis rarely occurring.

Chronic symptoms occasionally occur

represented by repeated attacks of discomfort or pain in the left lower quadrant with frequent and inadequate stools. Febrile attacks with localized tenderness and pain may also occur. Diagnosis is readily made or confirmed by roentgenogram following an opaque meal. The sacculations are clearly demonstrated; they often retain the barium after evacuation of the bowel.

Fig. 39. Male, forty-one years. Pain in abdomen, diarrhea, blood in stools for seven weeks prior to admission. Before each bowel movement has griping pain in lower abdomen. Exploration showed involvement of whole large intestine. The sigmoid contained a number of small, hard nodules. Ccecostomy performed. Diarrhea improved under local treatment. (Hitzrot's case.)

The significant features are: (1) diverticulitis is a disease of adult life. (2) The symptoms are similar to those of acute or subacute appendicitis, but the lesion being usually in the sigmoid, the symptoms are referred to the lower left quadrant, and are therefore like a left-sided appendicitis. (3) The inflammatory process almost invariably becomes walled off and leads to abscess and not to diffuse peritonitis.

Treatment. Operation is very rarely

indicated for chronic symptoms. Occasionally a chronic inflammatory process leads to exploration under doubtful diagnosis. The inflammatory reaction may have caused such thickening and induration of the bowel wall as to lead to a justifiable suspicion of carcinoma. Under such conditions resection may be indicated.

Acute symptoms indicate operation. Operation should in general be delayed

surgical procedure is drainage of the abscess and nothing else. Resection is not indicated and is to be condemned. (Figs. 27 to 34 inclusive.)

COLITIS

Idiopathic ulcerative colitis is of fairly frequent occurrence. The lesions develop first in the rectum, and later involve the bowel wall higher up. The mucous mem-

FIG. 40. Male, twenty-nine years Admitted in 1923 to medical service for chronic colitis. Several small ulcerations of rectum seen. Barium enema negative. Was entirely well after leaving hospital, save for occasional diarrhea. Fifteen days before second admission, noticed that abdomen was tender to touch just to the left of the umbilicus. No other symptoms. Physical examination showed a palpable, tender slightly movable mass, 6 cm. in diameter to the left of the umbilicus. Protoscopic examination, negative. White blood cells 21,000; polys. 58 per cent; lymphos. 19 per cent; eosinophiles 12–15 per cent. Operation: mass involving transverse colon; three stages resection. Pathology: large abscess 10 × 6 cm., communicating with a perforation in wall of transverse colon. Amebae were found in the pus. A caecostomy was performed at the time of closing the fecal fistula. Smooth course. Caecostomy closed spontaneously. Result good.

FIG. 41. Male, forty-seven years. Attacks of pain in left lower quadrant with diarrhea and blood in stools for eight months. Physical examination showed a poorly nourished man appearing chronically ill. In left lower quadrant there are several small, hard, non-tender movable masses.

until abscess formation, that is complete walling off of the products of inflammation. For the reasons given, such delay is safe if the case is carefully watched. The proper

brane is first congested then small abscesses develop. The ulcers result from sloughing of the wall over the abscess. The cause is unknown. The symptoms are pain, diarrhea with blood in the stools, tenderness along site of the colon, at times fever. The course is protracted and marked by remissions and exacerbations. In severe cases anaemia is marked and the patient becomes extremely weak and prostrated. Diagnosis is made by study of the stools, proctoscopy, sigmoidoscopy and roentgenogram. Amoebic and tuberculous ulcerations must be excluded. Treatment on the basis

of recent studies[5] should include, besides local measures, correction of distant foci of infection and perhaps vaccines. In refractory cases surgery may be indicated. This consists in establishing a fistula at the caecum, which puts the bowel somewhat at rest and allows better application of local measures. Ileosigmoidostomy has also been advised.[6] (Figs. 35, 36 and 39.)

AMOEBIC DYSENTERY

In amoebic dysentery ulcers occur in any part or throughout the whole of the large intestine, but the caecum is a favorite site. The ulcers are described as rather characteristic, with a relatively small opening in the mucous membrane which leads to a cavity in the submucous coat. They have been referred to as flaskshaped. Occasionally an ulcer perforates the intestinal wall and causes an abscess in the adjacent tissues. In the course of the disease abscess of the liver not infrequently occurs and is a serious complication. The symptoms are attacks of diarrhea with at times mucus and blood in the stools. The patient ultimately becomes anaemic, emaciated and weak. The diagnosis depends upon finding the amoebae in the stools. The condition is usually readily held in check or cured by emetin, e.g.

grain i.q.d. for 7–10 days. Local measure should also be employed. (Fig. 40.)

POLYPOSIS

Polyposis of the colon must be referred to as of some diagnostic importance. The lesion consists in tumors which vary in size from a few millimeters to several centimeters projecting into the lumen. They are usually scattered along the whole length of colon and rectum in countless number, though occasionally they are few and limited in extent. Their structure is "an adenomatous hyperplasia of the intestinal mucous membrane."[7] They often give rise to symptoms at an early age, namely hemorrhage and diarrhea. They show a marked tendency to malignancy (40 per cent). (Fig. 41.)

This lesion must be thought of in unexplained rectal hemorrhage especially in youth. Palliative treatment is unreliable; and resection is rarely successful on account of the extensive and low distribution of the lesions.

The object of this paper is to urge that in the study of obscure cases with indefinite abdominal symptoms full consideration be given to the large intestine. It is felt that this important area is far too often overlooked.

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A METHOD FOR PRODUCING
BLOCK ANESTHESIA OF THE SACRAL NERVES*

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FOR many operations, such as those on the rectum, in the urinary bladder, and on the perineum, anesthesia is ordinarily satisfactory when the sacral nerves have been anesthetized. Data published previously support this opinion.[†] The technic of sacral nerve block has been described elsewhere,[‡] but deserves representation whenever it is refined. Although indications and contraindications[30] may long remain stationary, technic gradually alters. I hope that ultimately a simple and effective method will result. Obviously it is only in minor details that the method now presented varies from that described previously.[31,34]

POSITION OF PATIENT DURING INJECTION

The subject is placed in the prone position with the longitudinal axis approximately parallel to that of the cart or table. The hips are elevated about 7.5 cm. by a pillow or other means. Occasionally it is advantageous not to elevate the hips; this is true in thin subjects, especially if the sacral region is prominent.

It is interesting to note that the introduction of the caudal needle is facilitated, especially in fat persons, if the patient rests the left side of his head against the pillow when the anesthetist is right-handed, and vice-versa. The patient's arms should not be under his chest.

Every experienced regional anesthetist who teaches methods of blocking the sacral nerves has hit upon similar devices.

It has been my experience in teaching that if this technic is followed it will increase the percentage of easy cases and reduce the difficulties. No previous skill or experience is necessary to execute these apparently minor points, and when such suggestions are followed less skill is required to insert the needles into the bony foramina. It is desirable that regional anesthesia, especially sacral block, should be widely used or that the methods at least be familiar to as many as have use for them. For this reason I shall attempt to offer suggestions, especially to the inexperienced, which make for a rather easy and effective method of inducing sacral nerve block.

SOLUTION AND ARMAMENTARIUM

The skin over the sacrum and adjacent area is surgically prepared first with ether and then with a 2 per cent solution of mercurochrome in acetone and alcohol. A small sheet with a medium-sized perforation makes a suitable drape. The armamentarium is next put in order.[32] The plunger and barrel of the syringe are removed from the solution in which they have been sterilized. The syringe is ready after it has been rinsed in sterile water and put together. Needles are sterilized by boiling. The lumen of a needle is protected by a stilette, the point and external surface by a metal guard.[22,32,37] Each needle is separated from its protector and stilette and irrigated with a few drops of sodium chloride solution. A 100 c.c. cup is filled with physiologic solution

† Refs. 21, 31, 34, 39, 40.
‡ Refs. 1–3, 5–20, 22–29, 31, 34, 35, 38, 41–63.
*Read before the Jefferson County Medical Society, Birmingham, Alabama, November 21, 1927.

of sodium chloride which has been brought to body temperature, and to this is added, from an ampule, 5 c.c. of 20 per cent procaine solution. The content of another ampule containing 1 c.c. of 1:2600 epinephrine solution is then aspirated into the syringe and discharged into the sodium chloride-procaine solution. The cup con-

of certain cardiac conditions, or if the patient is being prepared for cystoscopic examination.[31]

LOCATING AND RAISING THE PRIMARY SKIN WHEAL

A fine wheal needle, 10 mm. or less in length, is attached to the syringe, which
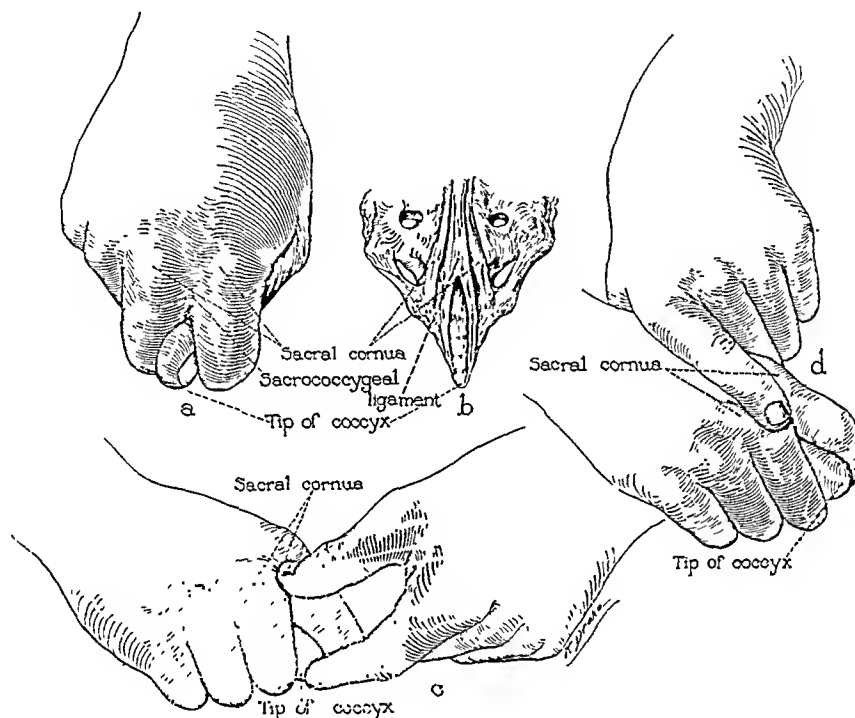
Fig. 1. Manual teaching exercise showing how the sacral hiatus is palpated. Extend the right thumb well through between the fully flexed first and second fingers of the right hand (A). Turn the back of the right hand upward. Palpate the tip of the right thumb with tip of the index finger of the left hand (c); with the tip of the left thumb palpate the niche between the proximal ends of the proximal phalanges of the first and second fingers of the right hand (c), the tip of the thumb resting slightly distal to the knuckles of the right hand (metacarpophalangeal articulations of the index and middle fingers). When this spot is noted the first maneuver is complete. In the second maneuver, bring the palmar surface of the left index finger to rest on the back of the right hand over the space between the second and third metacarpal bones (D). With the tip of the left index finger palpate the niche between the knuckles of the index and middle finger and slightly beyond. While so doing, slowly extend the index and middle fingers of the right hand; as they go from full flexion to full extension the palpable niche becomes quite shallow. Thus most of the sensations usually experienced in palpating the sacral hiatus are transferred to the tip of the left index finger. The knuckles represent the two sacral cornua, the web between the fingers represents the sacrococcygeal membrane (A and B). The point palpated in the first maneuver by the tip of the thumb (c) and in the second by the tip of the index finger (D) represents a point overlying the entrance to the caudal canal.

taining the procaine-epinephrine solution is marked with a small piece of red cloth to indicate the character of its contents. The solution is thoroughly mixed by repeatedly filling the syringe and discharging it back into the cup. Epinephrine is not used in the presence of goiter,[4,33,36] in cases of hypertension, in the presence

has been filled with the procaine-epinephrine solution. One should now prepare to make the skin wheal through which the caudal needle is to be thrust. I have previously emphasized the importance of locating the primary wheal properly.[31] A manual teaching exercise previously described[31] often facilitates an

understanding of this step in the technic (Fig. 1).

About 5 cm. proximal to the tip of the coccyx, a small wheal is raised in the skin, and one may proceed with the injection, which is usually accomplished readily if this primary wheal is properly located and raised. A common mistake in locating

PRELIMINARY INJECTION INTO THE TIP OF THE CAUDAL CANAL

A needle 50 mm. long and of medium caliber is next attached to the syringe and the point is inserted through the primary wheal and through the sacrococcygeal membrane into the caudal end of the sacral canal. The wheal is immobilized by
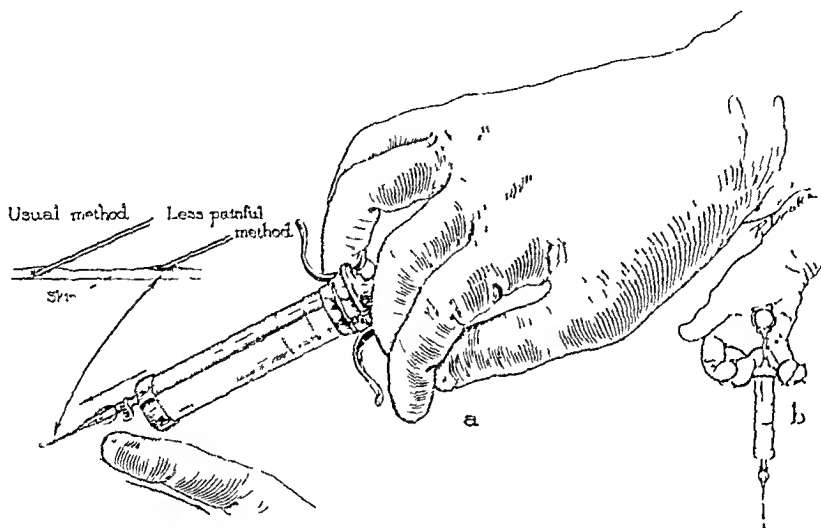
FIG. 2. A, Raising a wheal in the skin. The syringe is held in the middle of the right hand with the plunger against the thenar eminence, the offset nipple upward, the bevel of the needle down, the index finger of the left hand on the skin beneath the barrel of the syringe and pressing the skin toward the needle. Solution is forced through the needle continuously from the time the bevel almost reaches the surface of the skin until the wheal is raised. B, Palmar view: solution being forced through a very short wheal needle.

the primary wheal is either to make it to one side of the median line posteriorly or too high in the median line. By palpating the tip of the coccyx after the method illustrated and noting a point a short distance above it, one is more likely to avoid making the wheal too high. The skin wheal is more easily made and less pain is inflicted if the bevel of the needle is pressed against the skin and into superficial layers. This is the reverse of the method usually employed. Throughout the procedure procaine solution is forced through the lumen. Figure 2 illustrates the procedure of raising the wheal in the skin. The short wheal needle illustrated is a source of very little back pressure to the advancing plunger of the syringe as compared with the long wheal needles in general use.

pressure with the left index finger and the point of the needle is guided into the sacral hiatus (Fig. 3). Five cubic centimeters of procaine solution is now injected and the syringe detached, the needle remaining in situ (Fig. 4A). The 50 mm. needle serves as an indirect guide for the introduction of the caudal needle. It has been recommended that the needle be left in situ while the caudal needle is being inserted.[10,11] I prefer to remove the 50-mm. needle (Fig. 4B), and insert the caudal needle in its stead.

INSERTION OF THE CAUDAL NEEDLE

The caudal needle is grasped between the thumb and middle finger of the right hand, the index finger pressing the stilette into the needle. The left index finger is again returned to the median line and

the tissue is immobilized as in Figure 3. The 50-mm. needle is grasped between the right ring and little fingers and withdrawn and dropped; one must not glance away from the primary wheal (Fig. 4B). The caudal needle is thrust through the perforation made by the 50-mm. needle, the bevel of the caudal needle being kept

(Fig. 4B). It is especially advantageous to press the tip of the left index finger into the fossa between the sacral cornua in order to depress the point of the caudal needle and force it into the sacral hiatus (Fig. 4B). The caudal needle is advanced into the caudal canal until its point comes to rest at the level of the second sacral
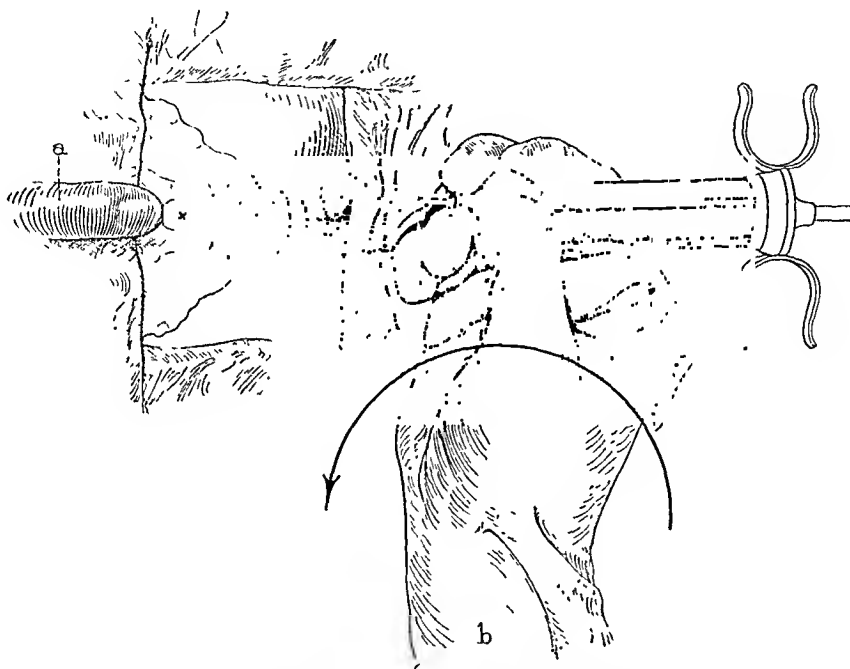
Fig. 3. Introduction of the 50-mm. needle. A, The left index finger. B, Right hand holding syringe and 50-mm needle. x, The spot through which the needle is to be thrust.

upward until bone is reached. It is then rotated by the thumb and middle finger, the index finger holding the point gently against bone. After the bevel has thus been brought against the bone, the hilt of the needle is depressed and the point advanced through the sacrococcygeal membrane into the caudal canal. When bony resistance is encountered at points low in the caudal canal the caudal needle is given a half turn (180°) and again advanced. The object of rotating the needle is to bring its bevel against the bony obstruction so that the needle will override it. With the left index finger one may massage the soft tissues overlying the sacrum and frequently facilitate the upward movement of the caudal needle when it apparently becomes lodged in the sacral canal

foramen. It is desirable that the point of the needle be brought as nearly as possible into the center of the caudal canal, that is, in the center of all its diameters. One may estimate how high the point of the needle lies in the canal by measuring with the stilette of the needle against the skin posterior to the sacral spines. If the point of the caudal needle seems to rest against bone, it is well to withdraw it slightly. If blood is observed when the stilette of the caudal needle is removed, one may be quite sure that the plexus of veins which lines the bony canal has been punctured. Obviously intravenous injection results if the point of the needle lies in this plexus. A small hematoma may form in the caudal canal. It is said that the tip of the dural sac usually extends

to the level of the second sacral foramen, and in a few instances I have obtained spinal fluid with the caudal needle at various levels, usually lower than the second sacral foramen, and have produced spinal anesthesia. If spinal fluid appears, the needle should be partially withdrawn so that its point lies well below that of the

FIG. 4. A, A 50-mm. needle is inserted through a wheal over the sacrococcygeal membrane into the tip of the caudal canal and 5 c.c. of solution injected to make the insertion of the caudal needle painless. B, The 50-mm. needle is withdrawn and the caudal needle inserted in its stead and advanced into the caudal canal, after being rotated so that the bevel rests on bone. C, Dorsal view of sacrum with caudal needle in position as well as those in SI, SII, SIII, and SIV (the first, second, third, and fourth sacral foramina). A total of 36 c.c. of solution is placed in the caudal canal in the average case.

dural sac, and a small amount, 5 to 10 c.c., of 1 per cent solution may be deposited in the bony canal. The principal part of

the block should then be attempted by transsacral technic.

INJECTION INTO CAUDAL CANAL

If no blood or spinal fluid appears when the stilette is withdrawn from the caudal needle, the syringe, not quite filled with procaine solution, is attached to the needle and gentle aspiration performed, first as the needle lies, and again after it has been given a half turn (180°). If no blood or spinal fluid appears on the first two aspirations, 0.5 c.c. of solution is injected through the caudal needle and aspiration is repeated. If still no blood or spinal fluid appears, injection is continued very slowly so that the progress of the plunger through the length of the syringe is hardly perceptible. Twenty cubic centimeters of solution is injected through the caudal needle, and this with the 5 c.c. already injected through the 50-mm. needle brings the total thus far deposited in the canal to 25 c.c. All the while that solution is being injected into the caudal canal through the caudal needle, the tissue posterior to the sacrum is palpated. If solution is injected on the posterior surface of the sacrum there should be tumefaction or at least back pressure against the advancing piston. When solution is being injected into the caudal canal under slight pressure respiration increases in depth and occasionally the patient sighs. This should occur, however, only at the time that pressure is being exerted, so that by bringing the plunger to a standstill and observing respiration and then advancing the plunger one may distinguish between the usual depth of respiration and that under pressure. Signs which indicate whether or not solution is being injected into the caudal canal are discussed elsewhere.[34]

It is now assumed that the caudal needle has been inserted into the caudal canal, that the point of the needle lies at a satisfactory point between the level of the fourth and second sacral foramina, and that a total of 20 or 25 c.c. of solution

has been deposited therein. The injection of the balance is postponed until after transsacral block. As a rule, good anesthesia of the sacral nerves may be induced by a caudal injection only if 30 or 35 c.c. of procaine solution at body temperature has been injected and allowed to penetrate the nerve trunks thoroughly for a period of from thirty to forty-five minutes. Not infrequently anesthesia may be unilateral or incomplete and it may be necessary to inject the first four sacral foramina posteriorly. Data relative to the use of caudal injection and caudal injection plus that of the sacral foramina for various procedures and types of operations have been offered previously,[31,34] and need not be repeated here, except to emphasize that one should be prepared to carry out complete posterior sacral block whenever one undertakes the anesthetizing of the sacral nerves.

TRANSSACRAL BLOCK

In discussing transsacral block, I have found a manual teaching exercise useful to illustrate the relationship of landmarks to be used (Figs. 5 and 6). In an obese subject the area immediately over the posterior superior spine will be represented by a dimple, in a thin subject it is very easily palpated, and in the average subject it may be palpated by gentle pressure. If considerable pressure is used, bone will be palpated in many places and the spinous process become confused with points on the edge of the ilium. Wheals are now raised in the skin over the second, third, and fourth sacral foramina which underlie a line about a finger's breadth lateral to the median line and at the following intervals: the second at a point near the posterior superior spine, about a finger's breadth caudad and mesial to the spine, the third about a finger's breadth below the second, and the fourth a finger's breadth below the third. In a large subject the foramina will be separated from each other and from the median line by a space corresponding to a large finger's breadth and

in smaller subjects by a small finger's breadth. It is of distinct advantage to make the wheals in the skin slightly lateral to the sites directly overlying the foramina for, if the needles are inserted through wheals which are too close to the median line, those on the opposite side cannot be retracted laterally because the
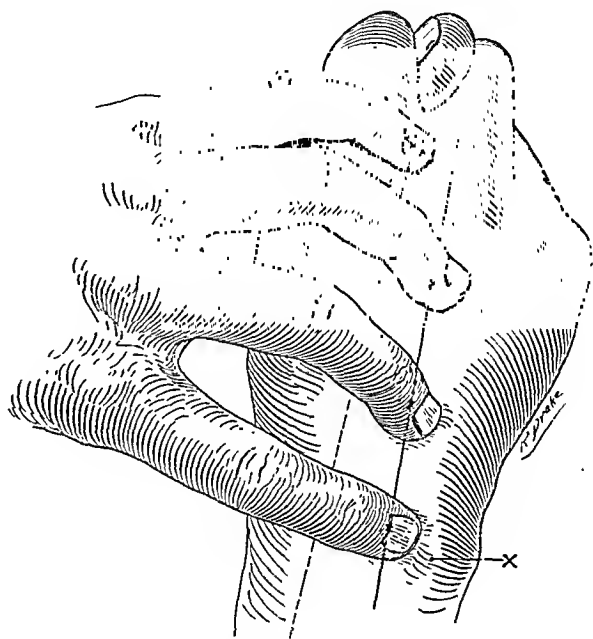
FIG. 5. Manual teaching exercise for locating the sites where wheals are to be raised over the second, third, and fourth foramina and sacral hiatus. The dot x is over the head of the ulna and corresponds to the posterior superior iliac spine. The broken line represents the posterior median line of the sacrum. The thumb of the right hand represents the coccyx as in Figure 1. The solid line represents a line overlying the second, third, and fourth sacral foramina and lies about a finger's breadth from the median line and about a finger's breadth from the dot x. The fingers of the left hand are resting on the sites where wheals are to be raised as represented by three small x's on the solid line and a small x at the end of the broken line. The fingers of the left hand are separated from each other by about a finger's breadth so that one may mark off from above downward the approximate positions of the second, third, and fourth sacral foramina and the site for the primary wheal. This maneuver completes those illustrated in Figure 1 and makes it possible to check the probable location of the primary wheal from above downward and from below upward; it is my practice to do both before raising the primary wheal.

skin will not stretch. However, a wheal raised laterally to the line overlying the foramen may easily be pushed toward the

median line. A needle may be broken off in the foramen if too much lateral traction
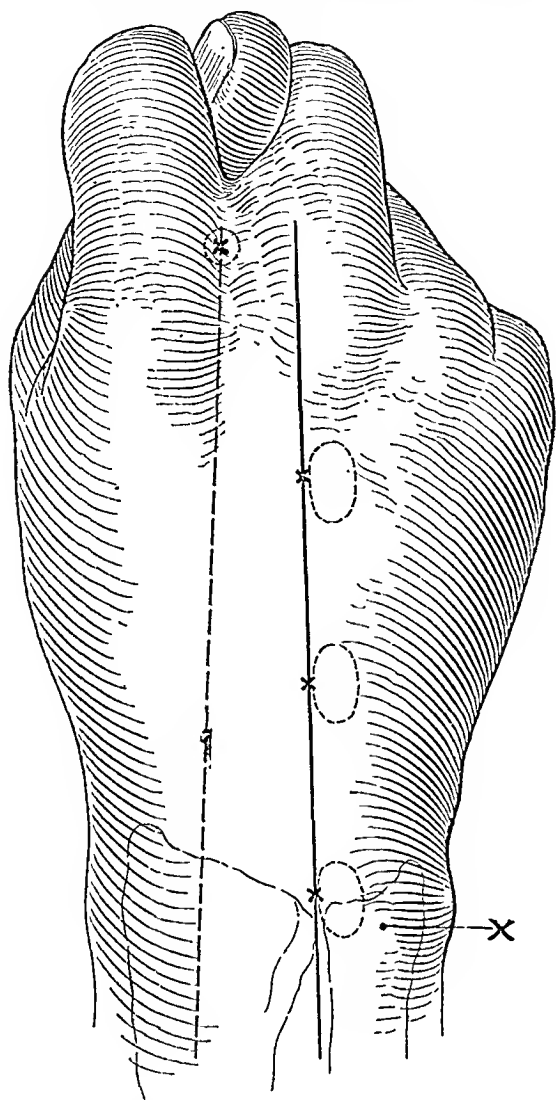
FIG. 6. The dot x represents the same structure as in Figure 5. The x within the circle at the end of the broken line represents the spot where the primary wheal is to be raised. The x's on the solid line represent from above downward the sites of the second, third, and fourth sacral foramina; the small circles in the broken line represent the sites which were pressed upon by the tips of the fingers of the left hand in the maneuver in Figure 5 and also represent the sites for the skin wheals. As is explained in the text, it is of advantage to raise the wheals slightly lateral to the site which overlies the mouth of a foramen, since skin may be readily moved toward the median line but cannot be moved easily in the opposite direction once the needles have been placed in the foramina on the opposite side.

is exerted on it when the skin through which it has been passed is put under tension. Figures 5 and 6 illustrate how one may confirm the probable location of the primary wheal from above by placing drops of solution on the skin where one intends to raise the wheals over the second, third, and fourth sacral foramina. The fifth sacral foramina occur a finger's breadth below the fourth and at a point opposite the usual site of the primary wheal for injection of the caudal canal. After the second, third, and fourth sacral foramina have been located, a wheal is raised a finger's breadth above the second on each side and the first sacral foramina are sought. The second, third, and fourth sacral foramina on the left side are injected while the anesthetist stands by the patient's left hip; those on the right are injected while the anesthetist stands at the patient's hip. The last needle to be placed is the one which is inserted in the first foramen on the left side, after the first on the right side has been injected and the anesthetist has returned to a position by the patient's left hip. The object of leaving the first foramina until the last part of the injection is to take advantage of any anesthesia which may develop in the lower sacral nerves from the injection of procaine through the caudal needle. The fourth sacral foramina may be injected almost painlessly after the caudal injection, the sensitiveness increases with the other injections, the injection of the first foramina being the most sensitive of all. The quantity of solution injected into the foramina is as follows in the average case: 3 c.c. in each fourth sacral foramen, 4 c.c. in each third, 10 c.c. in each second, and 15 c.c. in each first. After all the foramina on each side have been injected, an additional 5 or 10 c.c. of solution is injected into the caudal canal. The needles and the quantity injected through them are shown in Figure 4C. In the case of a weak patient it is often advantageous to inject half the amount of solution intended for each foramen as soon as the needle is placed, and the balance after all the needles have been placed and just before each is

removed. Each needle is watched and aspirated for blood or spinal fluid as has been described for the caudal needle. I have obtained spinal fluid once from the first left and once from the second left sacral foramen. In such cases the position of the needle should be shifted until blood or spinal fluid is no longer obtained. It is essential that the point of the needle be advanced halfway through each foramen. The desired depth of the point of the needle may be estimated by advancing the needle through the skin wheal and bringing the point to rest against the posterior surface of the sacrum; the length of needle remaining above the skin is measured in finger-breadths; the needle is then advanced into the foramen so that the part above the skin is shorter by a

half finger's breadth than when first measured.

As soon as injection is completed, the perineum in the median line posterior to the anus is tested with a needle and, if anesthesia or analgesia is present, the needles in the sacral foramina may be removed and the patient placed in position for operation. Hyperesthesia is frequently the first change noted and occurs in the area which later becomes anesthetic. Anesthesia may be expected within ten or fifteen minutes after injection has been completed; it becomes intense in twenty or thirty minutes and lasts for one or two hours.

If the canal cannot be located, twice the usual amount may be injected into each foramen and good anesthesia be produced without a caudal injection.

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PREOPERATIVE AND POSTOPERATIVE SURGICAL TREATMENT

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SUCCESS in surgery depends largely upon the observation of details, careful examination of the patient with reference to both local and general condition, and the strict preparation prior to the operation whenever possible. In the art of surgery the master word is simplicity.

Where emergency does not contraindicate, conditions would all be improved if a period of complete rest, both mental and physical, with pleasant diversion, moderation in food, reasonable exercise and freedom from worry and responsibility could precede all operations of consequence. Unquestionably some overfagged patients are particularly helped by spending two or three days in bed before operation, eating lightly and sleeping plentifully and peacefully.

It is rather a frequent incident for surgeons to have little patience with the anxiety and minor problems of patients in advance of operation. It has been my conclusion that these are the very men who, in all likelihood, would not more gracefully submit to the same ordeal themselves, and who would only too gladly welcome the comfort and utmost consideration in their own whimsicalities.

While some patients, probably the majority of them, are better prepared by lying quietly in bed and resting and sleeping for two or three days in advance of operation, others are rendered unnecessarily nervous and apprehensive by this unusual form of life; such patients, who are usually of the robust type, may be better prepared by allowing them more latitude, while at the same time simplifying their lives, letting them walk about, interest themselves quietly, take their own preliminary bath and so forth.

The patient's chief resources upon entering the operating room are his constitutional powers and his resistance, reinforced by cheery bravery, and everything possible should be done to increase these.

A general physical examination should be made in detail on every patient undergoing an operation of consequence. Careful examination should be made of the blood in all cases of acute and chronic infection, in anemic cases and in cases of marked hemorrhage. When indicated, the coagulation point of blood and the hemoglobin percentage should be known in advance, and when these are distinctly below normal the operation should be postponed if possible or performed with great caution, if in emergency. When it is indicated, the blood pressure should be taken, as no operation should be undertaken by choice during high blood pressure, if there is any chance of its reduction; in the same manner, the low pressure should be taken care of.

The underfed patient should be liberally nourished until brought to the requisite standard or to a standard which is compatible with operation, unless, again, it is in an emergency. The overfed, to whom the majority of the non-invalid class belong, should be correspondingly dieted sufficiently to relieve them of their overloadings.

The only needed restriction as to meals taken up to within thirty-six hours of the operation is: they should be somewhat lighter (less in amount) and more digestible (simpler) than usual. While light, nourishing, digestible diet can be taken up to the day before the operation, all nourishment should be stopped six hours before. If any part of the gastrointestinal tract is to be the site of the operation, an antiketonic diet as worked out by Matas is of value and should be prescribed for the last two or three days.

When the bowels are to be purged, it should be fully accomplished well in advance of the operation, so that there shall be no chance of its interfering. The tendency to too great purgation and saline catharsis has existed in the past; such a course may be harmfully depressive and dehydrating. Some operators advise the administration of different purgatives the second day before the operation, but in my experience, rather than take any chances on having the bowels act during operation, an enema alone should be given early in the morning of the day of operation, although of course its action is more local than a mouth purgative.

A prolonged, warm, full tub bath with a soap scrub is given, when possible, the day before the operation, including the entire head, as well as all mucous membranes which open on the skin, together with care of the finger and toe nails, and especial care of the mouth and teeth.

It is well to plan for the patient to have before the operation at least two or three hours of absolute quiet, undisturbed by any detail of preparation for the operation, with the time spent preferably in sleep. The precaution taken before the operation to disturb as little as possible the daily routine favors a more rapid and easy convalescence.

The bladder should be emptied just prior to going to the operating room, preferably voluntarily. Catheterization should be performed only when voluntary micturition is impossible.

I am not at this time going into the preparation of the skin of the operation site, except to say that it has been our conclusion at The Bayside Hospital, where we have tried out the various techniques of preparation, not to disturb the skin with various antiseptics and applications. The night before it is to be shaved well beyond the operative area, being careful to avoid cuts. After the patient is on the operating table the area is cleansed first with ether to remove all grease, then a 3.5 per cent solution of iodine is applied

and the field is ready. We have found this simple method very satisfactory in all cases.

PREVENTION OF POSTOPERATIVE COMPLICATIONS

Among the postoperative complications which we must consider from a preoperative standpoint are the pulmonary. Different methods have been suggested for the prevention of these complications. Some authors have satisfactory results with respiratory exercise, inhalation or other physical procedures. Others have tried to improve the pulmonary ventilation by stimulating the activity of the heart by means of digipuratum, or injections of 10 per cent solution of grape sugar. Furthermore, injections with afenilin, optochin and lecithol, intramuscular ether injections, as well as prophylactic pneumococcus vaccination. A new preparation, Mentophin, was tested by H. J. Willerding, with regard to its prophylactic and therapeutic effect. Mentophin contains 1 per cent of thymol, 3 per cent of menthol and 96 per cent of terpichin.

The patients receiving the usual preparatory treatment, consisting of an injection of 0.5 gm. of veronal the evening before the operation, or an injection of morphine and atropine, or morphine and scopolanine thirty minutes before the operation, were injected immediately after the intervention with 2.2 c.c. of Mentophin intragluteally, and the same dose was administered on each of the next two days.

These injections had no local or general reaction and were not painful. Young patients generally received only one injection immediately after the operation provided they had not previously had bronchitis, grippe or angina; the patients over fifty received two injections and sometimes three. The idea is that in cases where the patient might be expected to have some pulmonary complications this method is always indicated, and the conclusions are that although Mentophin is not an absolutely sure prophylactic remedy against

postoperative pulmonary complications, it considerably reduces the mortality and has favorable influence upon the course of the complication, should it appear.

In cases of vaginal operation or when the vagina is to be invaded during an operation, a douche of tincture of Green soap, ½ oz. to 1 quart of sterile water, should be given, followed by 1 quart of 1:5000 bichloride of mercury solution, then by 1 quart of normal salt solution.

Starling has advanced the belief that by preoperative purgation of the drastic sort, less used now than formerly, the important hormone, "secretin," which activates the pancreatic enzymes and acts as a stimulant to bile secretion and succus entericus, is largely removed. This leads to an abnormal intestinal digestive function and the production of acid bodies in excess of the deranged fat metabolism.

The condition of "recurrent vomiting," so called, in children is well known and its relation to an acidotic state substantiated. Conditions demanding surgical intervention are frequently accompanied by vomiting of various degrees so that vomiting itself becomes a factor in favoring an acidotic state.

Preliminary starvation of more than six to eight hours' duration leaves little for the normal processes of digestion to work upon and would call for a mobilization of the liver-stored glycogen and its use for body energy. After this has been exhausted or nearly so, incomplete or abnormal fat metabolism would occur. Under normal conditions in the presence of or contemporaneous with carbohydrate metabolism, little more than 5 per cent of fat escapes absorption. Following starvation, after stored sugar has been used, fat is called on, but its metabolism is imperfect because of the diminished carbohydrate. It is well known that preoperative infection is likewise a factor in favoring acidosis.

Crile has demonstrated that asphyxia which leads to suboxidation is in itself a cause of acid intoxication.

In view of the above it has been our policy at The Bayside Hospital as a routine, in cases of extreme emaciation, or where the patient is starved or dehydrated on account of inability to take food or water for any reason prior to operation, and in cases where the urine shows diacetic acid after operation, to give a 5 per cent solution of sodium bicarbonate and 5 per cent solution glucose rectally by the Murphy drip method, care being taken not to irritate the rectum.

In giving a narcotic prior to operation the time element plays an important rôle. Morphine begins to be effective in not less than fifteen to twenty minutes after hypodermic injection, and its effect rises or intensifies rapidly until about forty-five minutes, then more slowly until the peak is reached in about one hour. This is the ideal time for the anesthetic to begin.

When a loss of consciousness is desired (amnesia to preparation), scopolamine and morphine are combined by some. My objection to this combination is that there is a depression of respiration following scopolamine and morphine to the extent of the rate dropping as low as eight per minute. Thorek, however, states that there are no deaths due to this method.

The synergistic action of magnesium sulphate has been made use of but a few years, although the discovery which led to its use was made in 1915. The late S. J. Meltzer of the Rockefeller Institute, while experimenting for other purposes, noticed that two drops of a 5 per cent solution of magnesium sulphate injected intracerebrally in a rabbit produced complete anesthesia and relaxation lasting several hours. Repeated attempts, however, to use magnesium sulphate as an anesthetic agent demonstrated its ineffectiveness. Its combination with morphine, first suggested by E. J. Pelliric of the Pharmacologic Department of the University and Bellevue Hospital Medical College, was worked out and the effects determined in association with J. T. Gwathmey. Clinical results at the Presby-

terian Hospital showed that this combination increased the value of morphine from 50 to 100 per cent. Rector explains the action of the magnesium sulphate by saying that magnesium sulphate is a powerful medicine in hastening the absorption of morphine and probably also retards the formation of the oxide-morphine, which is produced by the process of oxidizing the morphine in the body. The details of this combination and administration I shall not go into at this time. Other things being equal, a preoperative narcotic shortens the time of induction and lessens the amount of anesthetic used. It is claimed that if the morphine is combined with magnesium sulphate solution it still further shortens the time of induction and gives a smoother anesthesia and decreases the amount of the anesthetic.

It has been our practice at The Bayside Hospital, unless contraindicated, to give morphine, grain $\frac{1}{6}$ and atropine, $\frac{1}{150}$, thirty minutes prior to the administration of the anesthetic. We have observed that the induction is short and the anesthesia smooth, with recovery in a remarkably short period, and nausea and vomiting a very negligible quantity.

POSTOPERATIVE CARE

The great importance of the after-treatment in abdominal surgery becomes evident in the vast majority of cases through the most harmful complications during the convalescence of the patient. This subject has always aroused considerable attention and interest and deserves serious consideration, since a considerable number of patients succumb as a result of irrational therapeutic measures. The fact cannot be emphasized enough, that rational and systematic after-treatment has to be regarded as being as important as a well-performed operation itself. In many cases the surgical intervention is disproportionate to the severity of the intercurrent complications. It often occurs that though the immediate results of surgical treatment are excellent, the end-results are far from ideal. The last few years of clinical investigations and experiences in some of the large hospitals have revealed many valuable methods of greatest importance serving to prevent and combat postoperative complications and thus to secure uneventful recovery for the surgically treated patient.

In approaching the postoperative care it is advisable for us to consider the conditions which usually arise following a laparotomy, and to establish a treatment which will to a large extent prevent these conditions from arising, rather than to wait until they are well established and then consider their treatment.

Patients who have been operated upon for goiter, lesions of the stomach or duodenum, including gastroenterostomies, resections and plastic operations, should be placed in bed in a semi-sitting posture at an angle of about 45 degrees, and this position maintained for several days. This applies also to patients operated on for infection of the lower abdomen and pelvis in which drainage is used, and in prostatectomies, and in the aged in general unless otherwise indicated. All other cases may be permitted to assume such posture as may be most comfortable, but too frequent change of position should be discouraged.

In postoperative shock, experience shows us that the results obtained by glucose intravenous infusion are superior to those obtained by saline, because the intravenously infused salines considerably lower the resorption power of the peritoneum. Here again we find insulin subcutaneously of value, giving 1 unit of insulin for every 4 gm. of glucose. In severe cases camphor in oil plays a major rôle. Of course it goes without saying that heat and rest are always used.

From time immemorial opium in some of its forms has been given for postoperative pain, and it does temporarily relieve the pain; but one must stop and consider that opium has many more physiological actions, some of which are highly undesirable, the three principal ones being that it

stops peristalsis, stops secretions and produces nausea. It has been our experience at The Bayside Hospital that 90 per cent of the cases of simple so-called postoperative pain can be effectually relieved with a combination of aspirin and aromatic spirits of ammonia, thereby avoiding all of the undesirable action of opium. Many operators relieve gas pains by morphine. This, in my opinion, is a very undesirable practice because of the retarding effects of morphine on peristalsis. I would prefer the aspirin and aromatic spirits of ammonia method, as this is effective in 95 per cent of cases.

Many cases which do not present any unusual features at the time of operation may develop most serious complications at its inception. It is especially wise to ascertain whether a circumscribed focus can be found, which may be responsible for all disturbances. The roentgen ray and the laboratory play a most important part in the detection of concealed foci. The wound itself should have a careful examination. In any case when we have tenderness, slight rigidity of the recti muscles, along with continued temperature and leucocytosis, intrabdominal abscess may have been overlooked at the time of operation, such as a subphrenic abscess or a subdiaphragmatic abscess in the pouch of Douglas (retrovaginal abscess). The treatment is too well known to mention here, once the diagnosis is made. Pyelitis and pyelonephritis as a postoperative complication are not rare, although commonly overlooked, and should be thought of at this time.

Postnarcotic emesis is undoubtedly due to a pneumogastric reflex action produced by the swallowing of saliva containing more or less chloroform or ether. This condition is handled by various operators in various ways. Some give $\frac{1}{60}$ grain of atropine followed immediately, postoperatively, by $\frac{1}{6}$ grain of lobeline, both being given hypodermically. Another method is an immediate gastric lavage with 3 per cent warm sodium bicarbonate solution or 2 per cent sodium chloride. These two methods have both given excellent results. I find that the giving of $\frac{1}{150}$ grains of atropine with my preoperative narcotic is usually sufficient to prevent any serious postoperative emesis.

Gastric lavage is practically effective in 97 per cent of all cases of postoperative thirst. This condition is brought about in long operative cases and is caused by loss of blood and perspiration during the procedure. It can be controlled largely by the administration of a slightly hypotonic glucose solution. I think this is due to the rapid absorption of hypotonic solutions and the concentration of salts in the dehydrated tissues. This I believe to be the chief reason for giving the glucose in preference to salt solution, as the salt would only add to the concentration of the salts and thereby increase the thirst.

Postoperative treatment is of great importance in surgery of the digestive tract, especially for the first week. At times one encounters some difficulty in administering sufficient fluids, when the stomach will not retain it and the rectum returns it. Blood transfusion and intravenous infusion, as we know, have only a transitory effect. Crawford H. deLisle has advanced a method of handling this condition by means of a stab wound through the right abdominal wall about 2 inches internal to the right anterior superior iliac spine at the level of the base of the appendix. The appendix is delivered through this wound and there fixed and is severed $\frac{1}{2}$ inch from the skin. Then a small catheter is introduced into the lumen of the appendix and liquids are administered by this route. He claims that by this method he never has any trouble with the stump of the appendix after its period of usefulness has passed, that the pulse is rapidly returned to normal, peristalsis is stimulated, the blood pressure is raised, the patient is fed without disturbance and the stomach is allowed to rest.

I have never used this technique and

do not think that I shall, as it appears to me that these cases, while they do occur, are in the minority by far, and unless one could be absolutely sure of this complication arising the cost of the game is not worth the playing.

The much-dreaded acute gastric dilation is not infrequent after abdominal operations, usually appearing in the first two or three postoperative days, and if it is not recognized and properly treated, will undoubtedly result fatally. The usual clinical picture is one of continuous vomiting, without effort, of large quantities of brownish, sometimes tar-like and almost odorless liquid; it is accompanied by sweat, rapid pulse and extreme prostration. In many cases the upper abdomen shows a well-marked distention, but it must be remembered that there are cases with absence of noticeable distention of the epigastrium. In this latter form the diagnosis of acute dilation is very difficult to make unless this possibility is always kept in mind. In such doubtful cases the continuous vomiting accompanied by unquenchable thirst and restlessness will clear up the diagnosis. When this complication arises probably the best procedure is immediate and thorough gastric lavage with 2 per cent sodium chloride. Some authors lay large stress on position, such as the deep Trendelenburg position or knee-chest position, their theory being that the beneficial effect of these positions is due to relaxation of the over-stretched mesenterium and to the relief of the obstruction.

In the avoidance of postoperative paralytic ileus the most important factor is prophylaxis, which should begin on the operating table, consisting of careful handling and protection of the bowels from injury. A hypodermic injection of ½ to 1 c.c. of pituitary extract should be given every one or two hours for the first six or eight hours after operation. Pituitary extract in these early postoperative hours, besides stimulation of the peristalsis, as a triple beneficial action increases the blood pressure, improves the blood circulation in the lungs, and stimulates the urinary bladder. If the obstruction is due to cessation of the peristalsis and the usual therapeutic measures are not efficient, large doses of 3 or 4 mm. of eserine, if intramuscularly given, are of great value. In the extreme cases the early performed enterostomy provides good results, with hypodermoclysis of 1000 c.c. of 3 per cent sodium chloride solution given twice daily to control the toxemia caused by the obstruction. It is well to remember here that the appearance of a dry tongue, rapid pulse, distended abdomen and nausea does not always indicate a generalized peritoneal infection, since these symptoms are also present in a simple paralytic obstruction.

The difference of localization and duration in the simultaneous appearance of emphysema and suppuration is evidence against the identical origin of the two phenomena on an infectious basis.

The etiology of postoperative abdominal emphysema in general surgery has not been clearly explained. According to H. Freund, subcutaneous abdominal emphysema is rarely seen in convalescence after colectomy. The earlier assumption that air penetrates during the operation is not impossible, yet it is more probable that the supposition that anaerobic bacteria, which have been enclosed, are the cause. Gas gangrene with its characteristic livid, gray-green discoloration of the skin and soft crepitation upon palpation, especially in wounds from splintered shells, was of common occurrence on the battle field. The clinical symptoms alone leave no doubt that a serious, rapidly-progressing wound infection is present. The direct infectiousness of the disease, which makes strict isolation imperative, has been satisfactorily proven.

Traumatic emphysema in surgery has long been recognized and has been attributed to active sucking in of the muscles or fascia. Subcutaneous emphysema, which comes about after injury to

the pleura and lungs with or without pneumothorax and which is often of extensive development, is also well known.

A summary of reported cases would indicate that gas-forming anaerobic bacteria of pathogenic nature are inclined to be latent, limited affections where they lack their favorite substratum. Bacilli coli as well as the anaerobic streptococci and staphlococci are never found to be the inciting cause of emphysema of the abdominal walls.

As to acute retention of urine, it must be borne in mind that in a number of these cases the previously given morphine is responsible for the cause, which can be quickly relieved by the application of a hot waterbottle to the bladder region and the subcutaneous injection of pituitary extract. Catheterization should be used only as a last remedy, since all patients with lowered resistance are inclined to infection, and cystitis and ascending pyelitis of exogeneous origin are not rare occurrences.

The reported success of several authors with extravenous injections of urotropin and cylotropin solution in the treatment of postoperative retention of urine suggested this method to Krieger; of the two drugs she favors cylotropin and prefers to administer it in the first six postoperative hours.

In females as well as in males after an operation, especially upon generative organs, there is sometimes difficulty in voiding, thereby adding unpleasant complications. This in the first place may be due to the simple fact that the patient is unable to void in a recumbent position, so it is well, if time permits, to accustom the patient to void in this position prior to the operation. Other causes of this condition are injury to the bladder wall, and pain caused by the urine coming in contact with the wound, which may also discourage the patient from permitting the passage of urine. The common treatment for this condition is the oral administration of diuretics, but this is not always

found to produce satisfactory results. The routine resort to the catheter is not always wise, as it may result in cystitis in some conditions, regardless of how unimpeachable the technique may be. It has been found however by Heinz Kustner that the intravenous injection of a 40 per cent solution of urotropin affords relief in such cases. He does not administer this immediately after the operation, but rather waits for spontaneous micturition, as it has been found that urotropin given intravenously immediately after an operation on an empty bladder will produce an irritation of the mucous membrane of the bladder, and even hemorrhage and tenesmus. The acceptable time to give this is the evening after the day of the operation. At this time, if no voluntary micturition has occurred and you know that the bladder is full or distended, then give 5 c.c. of a 40 per cent solution of urotropin intravenously, and usually spontaneous micturition will follow shortly after the injection. However, it is only with the exceptional case that we have any difficulty at The Bayside Hospital.

Postoperative bronchitis and bronchopneumonia are now treated through the synergistic action of atropine and lobelin mentioned above, and their intercurrence is becoming rare. As a large portion of postoperative bronchitis and bronchopneumonia cases are caused by hypodermoclysis given in the chest, the abdominal type of respiration is, after abdominal operations, considerably suppressed and the thoracic type becomes more prevalent.

The painful hypodermoclysis given in the chest, results in the impairment of the thoracic breathing with consequently shorter amplitude of respiration, thus causing an insufficient ventilation of the lungs and giving rise to pulmonary affections. For this reason hypodermoclysis, as a rule, should be given in the outer surface of the thighs.

Not uncommonly in cases of chronic appendicitis, the type associated with constipation or ptosis, acetonuria is found.

In those cases with stasis on the one hand and with a general large bowel sluggishness on the other, toxic agents are produced which have a relation to increased acid-body production.

Regarding the importance of a postoperative complication, it becomes necessary to the surgeon to forearm against it; means for so doing are suggested in the causes themselves. Excessive purgation and prolonged starvation should be interdicted. Morphine and atropine should be used sparingly.

In toxemia cases, i.e., cases of chronic appendicitis, for example, or ptosis, patients often show acetonuria. Crile showed that in various types of autointoxication the toxic agent produced an increased activity of the adrenals and increased adrenalin. In keeping with deductions concerning the role of the sympathetic in operations, the increased adrenalin in autointoxication might indirectly affect pancreatic secretion.

Two factors not readily controlled are, first, infections of the organs of surgical attack and, secondly, manipulation. The latter can be minimized to a large extent, depending on the skill of the operator, by injection of abundant fluids to dilute the toxins in infectious conditions and hasten their excretion, thus mitigating this as a factor in excess acid production.

While I have not tried it, it would seem from the experience of others that it would be an excellent preoperative prophylactic measure to administer glucose and insulin together, especially in operations of the upper abdomen.

Hiccough is recognized as a clonic spasm of the diaphragm, sometimes involving only half the diaphragm. The conditions which develop hiccough are so numerous that it loses its value as a symptom. It may develop as a result of cerebral disturbance, of stimulation of the respiratory center, by venus blood, in uremia and acetonuria, and as the result of stimulation of the sensory fibers of the vagus and the sympathetic nerves.

Hiccough occurs most frequently in those cases in which the abdominal viscera and their peritoneal coverings are affected, and next in frequency in diseases of the brain and spinal cord. It is observed but rarely in diseases of the thoracic viscera.

Fatal hiccough is probably caused by alteration in the maternal blood. Its occurrence in infections is probably due to the absorption of toxins or the retention of metabolites. Hiccough after operations upon the abdominal viscera are usually reflex in character. The phrenic nerve contains centripetal fibers which may influence the respiratory center. The wider distribution of the phrenic nerve in the abdomen than in the chest accounts for the relative infrequence of hiccough in diseases of the chest and its frequent occurrence in diseases of the abdominal viscera. Hiccough occurs in diseases of the thoracic viscera only when the lesion is situated close to the points at which the fibers of the phrenic nerve are given off, namely, the root of the lung, the arch of the aorta, and the pericardium.

Operations on the gall bladder and the stomach are most frequently followed by postoperative hiccough. This occurs more frequently in men than in women, probably due to the lessened diaphragmatic excursion in women. It is more frequent in adults than in children, due to changes in breathing, and is a condition hard to control. Gastric lavage combined with morphine gives most frequent relief, sleep in these cases being positively essential.

The injection of the phrenic nerve with alcohol has been advocated, but this procedure should be reserved until last and then resorted to only to sustain the life of the patient.

In postoperative acute anemia, the general reaction of the human organism to loss of blood is very different. Sudden severe hemorrhage acts as a shock on the vasomotor center and cardiovascular system. The immediate restoration and sustenance of the necessary blood pressure without

causing any harm to the patient is a vital question and often encounters great difficulties.

Concerning blood transfusion, results are most satisfactory, but it must be borne in mind that in spite of careful preliminary tests and unimpeachable operative technique death may occur. Some authors prefer the direct transfusion over the citrate method, although it has been our experience at The Bayside Hospital that very satisfactory results have been obtained with the citrate method. The amount given with either method varies from 400 to 600 c.c., care being taken to avoid a dry cough (indicating acute cardiac dilation) and cyanosis (imminent hemolysis). Should either of these symptoms appear, the transfusion should be stopped and replacement of lost blood should be continued by infusion of indifferent solutions. Statistics show the mortality to be, with transfusion 2.7 per cent, without transfusion 6.6 per cent.

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THE PRESENT DAY TREATMENT OF
ACUTE GONORRHEA IN THE MALE*

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IN the successful treatment of acute gonorrheal urethritis, we have the key to the entire problem of gonorrhea in the male. It is obvious that if the acute infection is properly treated, there can be no complications and no chronic hangover. If one were to ask why we do not cure all of our acute cases, the answer would be that there is no single method of treatment which meets with universal approval. This is made evident by the innumerable methods of therapy which have been recommended for this condition. Still more to the point, however, is the fact that we cannot fore-tell how any given case will respond to a particular method of therapy. What is useful in one case might be distinctly harmful in another. This disturbing fact has led an English surgeon[1] to say that "the cure of gonorrhea is an act of God; the cases which one expects to do well do badly, and the cases which one expects to do badly do well." Nevertheless, in spite of the fact that our treatment of gonorrhea has been more or less empirical in character, much progress has been made within recent years; and in the short time allowed for this paper, some of the outstanding advances which have contributed to this progress, will be considered.

One of the cardinal errors in treatment is the tendency to seek a hasty cure of the acute infection; this leads to overtreatment, which in turn predisposes to trauma and eventual chronicity. The cure is the aim in view, not the time it takes to do it. In our zeal to hasten the cure, we are apt to cause much damage. Nature can-

not be rushed. Any method of treatment to be effective must have one ideal in view, to eliminate the invading organisms without injury to the tissues. It is not necessary to kill the gonococcus outright; being an organism of low resistance, it can be destroyed by almost any chemical substance having antiseptic properties; the problem is to reach the deep-seated organisms and destroy them without at the same time damaging the tissues in which they are embedded.

When the multitude of methods and remedies is sifted down to those which have proved themselves of value, certain basic methods stand out preeminent. Internal medication is the oldest. The first man that was treated for gonorrhea undoubtedly took something internally. It is only a few years back that santal oil and other balsams constituted the first line of attack in acute gonorrhea. Modern therapy considers them not only useless, but actually harmful in the acute stage, though useful at times in the later stages. Because the gonococcus does not thrive in an alkaline medium and the patient is much more comfortable through frequent flushing of the urinary tract, an alkaline solution and the intake of much water constitute the most useful internal medication. Recent additions to internal therapy are neutral acriflavine in enteric-coated tablets, and pyridium, a substitution product of pyridine, which is said to destroy the gonococcus without injury to the tissues and without the aid of local therapy.

Local treatment aims to apply medica-

tion to the affected tissues, and in this field our greatest successes and most striking failures have been achieved. We are prone to forget that the urethra is not a test-tube. It is in fact part of a living organism, sensitive to the slightest trauma, whether it be in the form of a bacterial invasion, a chemical substance or a surgical instrument. The urethra will not tolerate violence of any kind, however well-intended it may be. Anything put into the inflamed urethra acts like a foreign body; the stronger the solution, the greater the trauma and the greater the reaction. Any form of treatment which causes pain or irritation is distinctly harmful. Medication therefore should be the mildest possible consistent with effectiveness, not the strongest that the patient can tolerate.

Two forms of local therapy have survived the test of time, copious irrigations under hydrostatic pressure, and the local application of silver salts made with the small hand syringe. The Janet irrigation with potassium permanganate is the standard irrigation method, but it is not so popular as it was twenty years ago. Some men still advocate it. In his excellent book just published, Burke,[2] an English authority, denounces hand injection and favors hydrostatic irrigation. He says: "The patient is indeed wretched to whom treatment is meted out with a urethral syringe. It is the most dangerous and most abused instrument in the surgeon's armamentarium . . . The urethral syringe is almost a national danger." Strong words, but the identical language may be employed and has been, in favor of the hand syringe as against the irrigations. Every man to his own taste. I discarded the Janet irrigations in acute urethritis many years ago as being harmful, dangerous and less effective than the silver salts.

There can be no denying the cleansing value of warm fluid in large quantity flowing in and out of the inflamed urethra. But it is a dangerous procedure in the presence of an acute inflammation, especially in the hands of the careless and inexpert. The urethra is traumatized, the infection becomes more intensive and extensive, and complications are frequent. I believe that prostatitis and epididymitis are caused by the trauma of these irrigations as often as by any other cause. Moreover it has been shown by Kohnstamm and Cave[3] that fluid can be driven into the seminal vesicles by forced injection from the urinary meatus. And who can say that gonococci and other organisms are not carried directly into the seminal vesicles in this manner? This fact is considered by Sir John Thomson Walker[4] "a practical demonstration of the evil of applying high pressure in urethral irrigation."

Any stream of fluid which induces pressure against the urethral walls greater than that of the usual urinary stream, is a menace to the integrity of the urethral mucosa. This is exemplified by a report[5] of a postmortem examination in Prague made on a man who had been irrigated one hour previously with a 1:500 solution of potassium permanganate at a height of 1.65 meters (five feet). Microscopic examination of the anterior urethra showed splitting of the inflamed, friable mucosa in many places. I believe the Janet irrigations should be discarded entirely in acute gonococcal urethritis. I might add that they are of great value in the non-specific type of urethritis. More recently mercurochrome, acriflavine, collene and other preparations have been used for irrigation with varying success; but it matters little which chemical is employed, the dangers inherent in the method are the same.

Furthermore there is no reason for using this method when better results can be obtained with less danger of trauma and complications by the use of the silver salts applied with the small hand syringe. The particular silver salt to be selected is a matter of personal choice. If it is well chosen and properly administered, a prompt response will make that fact

evident; if the response is tardy or unfavorable, there is something wrong with the remedy selected or its administration. Many silver preparations are available and all have their advocates. My personal experience has been limited to protargol, argyrol, lunosol and more recently to a Czechoslovakian preparation known as neoreargon. All of these are valuable. The most striking results have come with neoreargon; the most consistently dependable with argyrol.

The successful use of the silver salts demands strict adherence to certain well-defined, but not always observed, technical principles. Silver solutions should be made fresh every day, otherwise they lose their efficiency and irritate the mucosa. A weak solution in the beginning of the infection gives better results than a strong one. As the case proceeds and the inflammation gradually subsides, the strength of solution may be increased, but never to the point at which the patient feels a sense of smarting or irritation. Treatment should be begun as soon as the diagnosis has been made, the earlier the better. Nothing is to be gained by waiting. The anterior urethra should not be distended with the fluid; it should be comfortably filled. By actual test it will be found that about one-third of the amount injected will enter the posterior urethra imperceptibly, thereby probably acting as a prophylactic against posterior involvement.

The patient should be seen every day and the urine, voided in two glasses, carefully inspected at each visit. This is extremely important, but many practitioners treat gonorrhea without ever seeing the voided urine. The amount of pus obtainable at the meatus is of little value in determining the progress of the case; but a clear urine in the second glass and a decreasing purulency in the first, constitute real evidence that an acute case is progressing favorably.

Bacterial organisms may develop a form of "fastness" when attacked by the same chemical substance continually. It is likewise recognized that there are many strains of gonococci, some of which are affected by one chemical while others react to another. It is therefore desirable to change the medication from time to time, especially when the voided urine persists in remaining purulent. In some cases, it is wise to suspend local treatment entirely for a time.

Persistence of the gonococci after three or four weeks of treatment is highly suggestive of prostatic invasion, even though there be no clinical evidence of posterior extension of the inflammation. In such cases, the prostate and seminal vesicles should be examined and carefully observed.

In the highly favorable cases these contingencies do not arise. The gonococci do not show "fastness," they quickly disappear under appropriate therapy, and the urine becomes clear with possibly a few shreds. At this stage the silver solutions may be superseded by a mild astringent, preferably zinc sulfate, 1:200. Here again one must keep a watchful eye on the voided urine. Any returning haziness or purulency in the urine serves notice that the astringent solution is irritating the mucosa or that occult bacterial organisms have become active. The microscope determines which of these two conditions prevails and the treatment is modified accordingly.

With a clear urine at this time, it is well occasionally to dilate the anterior urethra with the Kollmann dilator; some prefer the steel sound. The urethroscope may be used to locate any possible damage to the mucosa. If this produces no untoward result the treatment is gradually suspended and the patient placed under observation for several weeks. All of this may take from five to ten weeks, but I should consider it a great achievment if we could cure every case of acute gonorrhea in ten weeks.

Particular notice must be directed to a very important class of cases to which I have called attention elsewhere.[6,7] These cases go on for several weeks as a mild

anterior urethritis. Suddenly it is observed that both urinary glasses contain purulent urine. In some cases, the second voided urine is more purulent than the first. In either event, it means that the posterior urethra has become involved, even though there are no posterior clinical symptoms of any kind. The discharge at the meatus may be slight or nil. Rectal examination shows the presence of a large, soft or hard prostate, usually associated with enlarged vesicles. The urine voided after cautious massage of the adnexa, gives evidence of the existence of a chronic inflammation. Pathologically, the picture is that of a low-grade non-specific prostatitis of long standing in a patient who has acquired an entirely new and independent acute urethral infection. The congested adnexa in these cases offer an inviting soil for invasion by the gonococcus. If recognized early, the prostatitis responds quickly to gentle massage and mild intravesical irrigations. If this condition is not recognized, the prostate quickly succumbs to the gonococcal invasion and we now have to deal with an acute specific infection superimposed upon an old non-specific prostatitis, with a very decided tendency to chronicity. Since making this observation, which has been confirmed by Wohlstein,[8] it has been my practice to examine the prostate in every case of acute urethritis, with the result that many potential posterior infections with possible complications thereby have been averted.

Additional methods of treatment have been devised in recent years, but their future status remains undetermined. They aim to utilize the natural forces of the body in resisting the attack of the infectious process. The oldest of these measures is the use of vaccines. Opinions vary as to their value in acute gonorrhea, but the consensus of opinion is that vaccines have little if any value in uncomplicated acute cases. It seems that they have a stimulating value, however, in certain cases in which there is a sluggish response to local measures.

Foreign protein therapy also aims to increase the natural body resistance and is used extensively. Principal among the substances employed are sterilized or boiled milk, turpentine, typhoid vaccine and other protein substances injected intramuscularly or subcutaneously. The reaction which follows is a biologic response of the body, the natural resistance of which is increased by these agents. A combination of milk intramuscularly and an antistaphylococcal vaccine subcutaneously in the lower abdominal wall has been employed with success in Germany.

Autoserotherapy is said to exert a remarkably sedative action on the inflammatory process, especially in the presence of complications. The technic is simple: A few c.c. of blood are drawn off and incubated; of the resulting serum, 0.5 to 1.0 c.c. is injected intramuscularly every few days.

Intravenous therapy has been used for the direct attack on the infectious process through the blood stream. It is believed, according to Dale, that the injection of chemical substances directly into the blood acts somewhat like a protein injection; that the toxic effect on the bacteria is secondary and not direct; that they do not kill the parasites directly and immediately, but modify their virulence or lower their resistance to the body's natural defenses; that they form in the body some directly toxic products either by modification of its structure, or by its union with some tissue component, and that they have an affinity for certain cells of the host's body leading to the formation of a depot from which the curative substance is released.

The most prominent of these substances is mercurochrome 220. Young and his associates have used it with success in about 60 per cent of acute infections and their complications. Young regards the failures as having been due either to insufficient treatment or to the early development of reactions which prevented continuation of the treatment. The greatest objection

to mercurochrome is found in its toxicity, according to Braasch and Bumpus. In their experience severe reactions marked by prostration, chills and dysentery were common. Death occurred in two of their cases. Mercurochrome is not recommended as a substitute for the silver salts, but as an adjuvant to the local treatment. Young believes that mercurochrome intravenously attacks and destroys the gonococci in the deeper tissues, but the bacterial organisms on the urethral surface seem to escape its influence. It is therefore necessary to use the silver salts to combat the surface organisms.

Recently a modified method has been employed with much success in the United States Navy. Mercurochrome is given intravenously in a 1 per cent solution with 50 per cent glucose, in 10 mil doses. Milk and sugar solution is injected in the buttocks at the same time. The effect has been to diminish the severity of the reaction and to hasten the cure, in seventy cases thus treated.[10,11] Acriflavine and metaphen also have been used intravenously with more or less successful results.

McDonagh of England has devised a novel method of chemotherapy based on his original theory of oxidation and reduction, which has been highly praised by some and rejected by others.

Diathermy aims to destroy the gonococcus by the application of heat to the invaded tissues, and by increasing the body resistance. In acute anterior urethritis, the results have not yet justified our earlier expectations. In certain cases it is useful as an adjuvant to the local use of silver salts. Generally speaking, we can safely say that the silver salts, at present, constitute our most dependable and effective agent against acute gonococcal infection.

Thus far we have been considering those cases which have been confined clinically to the anterior urethra. It is immaterial for present purposes whether we accept or reject the view held by many that every case of acute gonorrhea extends by contiguity to the posterior urethra. Even if that view is correct, which I doubt, it nevertheless is true that a large proportion of cases do not show any evidence of posterior involvement, and therefore for therapeutic purposes, must be considered as being confined to the anterior urethra.

When the posterior urethra frankly is affected, the purulent urine voided in both glasses makes evident the fact even before the patient himself notices any change in his condition. The most that therapy can do in the circumstances is to check the severity of the inflammation and thereby prevent the development of complications.

Internal therapy remains the same as in anterior infection except that the water intake should be increased to the maximum capacity of the patient. For the chordee, camphor monobromate, two to five grains, is the classic remedy, but it often fails. Hot penile immersion may be more effective at times. Bromides and lupulin are used for the same purpose.

Hydrotherapy is of great value in the form of hot sitz baths and hot rectal recurrent irrigations. If there is evidence of previous over-treatment, the acute condition will be relieved by a cessation of all local treatment and the internal administration of a mild urinary sedative.

In the average case conservative local treatment is continued as before. Of course it is a difficult matter always to resist the temptation to wash out the deep urethra once or twice daily with an antiseptic solution; and while the results sometimes justify this common practice, it is as likely as not to be the exciting cause of an increased inflammatory reaction leading to epididymitis and other complications. If irrigation must be done, it is best done at a minimum risk of damage, with the Carleton hand syringe. The best way to treat the acute posterior infection is to leave it alone. A mild silver salt injection applied to the anterior urethra usually suffices to control the posterior infection in a most satisfactory manner. As already

mentioned, a small quantity of the injected solution enters the posterior urethra without violence or trauma and controls the inflammation until the acute stage has passed. This observation has been confirmed by Wiechowski, Klausner and others. With the passing of the acute inflammation, deep instillations of silver nitrate, 1:200 or protargol 10:100 are instituted. At the same time, the posterior adnexa are carefully observed and cautiously massaged. This acts as the most effective prophylactic against the development of a chronic inflammation. Young has recommended the instillation of mercurochrome solution as an antiseptic after prostatic massage.

Unfortunately many posterior infections do not respond so favorably to treatment. Certain cases are distinctly malignant in character almost from the outset; the inflammatory process instead of subsiding persists with increasing severity, in spite of any and all treatment, possibly because of it. The urine remains markedly purulent, often tinged with blood; the adnexa are intensely inflamed, large and tender; urinary distress reaches the maximum degree, even to the point of complete retention. It seems as though prostatic abscess or epididymitis must be the inevitable sequence, and very often this is exactly what happens. Foreign protein, vaccine and intravenous therapy often prove useful in these cases, but we have in vasotomy and diathermy two therapeutic agents which have demonstrated their great value in meeting this difficult situation.

Acting on the suggestion of Belfield, I have performed bilateral vasotomy in these cases as a prophylactic against the impending complication, with most gratifying results. Not only is the threatened complication averted but the entire infectious process takes on a much more benign aspect in every respect. Diathermy also is extremely useful in these cases, but its results are slower and less certain than those of vasotomy. Diathermy may be administered either with a prostatic electrode in the rectum, or with a pad electrode on the perineum, the indifferent electrode resting on the pubic region. The latter method is the more comfortable for the patient and probably more effective.

Prostatic abscess also frequently responds to these measures by bursting spontaneously into the urethra. If this does not occur, surgical incision and evacuation are indicated. Chemotherapy as advocated by McDonagh is said to abort these severe prostatic infections without recourse to other measures than vaccine injections after the use of his preparations.[12]

What has been said of the prostate applies equally to the seminal vesicles. These sacs are so closely connected with the prostate that they must be considered as one in the clinical sense. Vasotomy is by far the method of choice in the medication of the infected seminal vesicles, because it is the only method which positively reaches the interior of the sacs and the ejaculatory ducts. It is practically without pain and not followed by reaction. Stellwagen[13,14] injects five to ten c.c. of Pregl's iodine solution directly into the affected seminal vesicles through the rectum. He has had considerable success with this method.

Acute epididymitis stands next in frequency. The venerable hot poultice and ice-bag still are used frequently, but this means incapacitation for several weeks and a permanently damaged epididymis. Strapping has passed into the discard where it belongs. Recently introduced methods of treatment have done much to diminish the pain and prostration and the degree of permanent damage to the organ. Diathermy is the most useful of these; it is practically a specific. The pain is almost immediately controlled and the incapacitation is reduced from weeks to days.

Intravenous therapy also is employed, especially sodium iodide in distilled water, either alone or combined with methenamine. Mercurochrome, acriflavine, metaphen and similar substances have been used with varying degrees of success.

Non-specific proteins, especially milk and turpentine, are effective agents, relieving the pain and reducing the temperature within a few hours after the first injection. Vaccines are effective but not dependable. Young has injected a one per cent solution of mercurochrome directly into the inflamed epididymis, while Luys, of France, employed electrargol in the same manner with much satisfaction. Hagner's epididymotomy is the surgical method of choice, especially when pus is present. It would appear, however, that this useful procedure will become decreasingly necessary with the technical improvement in the methods just enumerated.

It goes without saying that with the passing of the acute inflammation of the epididymis, the infection in the seminal vesicles still requires serious attention because of the close etiologic relationship between vesiculitis and epididymitis. The same is true as regards acute arthritis, the most serious of the complications. There can be no effective treatment of the arthritis which does not include the eradication of the vesicular infection as the primary step. Everything else is secondary and merely palliative. For that reason, vasotomy may be considered almost a specific in arthritis; it eliminates the septic focus. Diathermy applied to the prostate and seminal vesicles also is very effective. Cumberbatch[15] and Corbus[16] acting on the principle that the infected joint is a metastatic extension of the basic vesicular infection, apply diathermy to the adnexa, with excellent results as regards the arthritis.

Stellwagen[13,14] has injected Pregl's solution into the seminauslly vesicles, as previo mentioned, with excellent effect on the affected joints. He states that the best results are obtained in the extremely acute joint cases with much effusion. Mercurochrome intravenously and the other preparations already mentioned are used, but the results are uncertain. Vaccines and foreign proteins, acting on the natural body forces, often show striking results in arthritis; but the main thing is to reach the infection in the adnexa and the joint itself will quickly respond.

It is necessary to add a word regarding the minor complications of acute gonorrhea. In order of frequency they are, balanitis, phimosis, paraphimosis, periurethral abscess, cowperitis and inguinal adenitis. The treatment is purely surgical.

Summary. Outstanding features of present day therapy of acute gonorrhea are the following: silver salts locally; copious water intake, supplemented if desired by an alkaline solution or one of the new chemotherapeutic preparations; avoidance of overtreatment; examination of the prostate in all acute anterior cases for an old non-specific prostatitis; in posterior involvement, the less local therapy the better; vasotomy and diathermy to avert acute complications; diathermy which is almost specific for epididymitis; vasotomy for arthritis and vesiculitis. Future progress lies in the direction of utilizing the natural forces of the body to combat the bacterial invasion.

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MODERN TREATMENT OF CHRONIC URETHRITIS*

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RECENTLY on receiving a request from our chairman to read a paper on the present day treatment of chronic urethritis, I tried to review some of the things that had been advocated,—serums, vaccines, electrotherapeutic measures, medicaments by the hundreds,—each of which at some time has been advocated as a cure-all. Their number alone should make us doubt their individual efficacy.

It must be conceded that progress in the treatment of urethritis has not kept pace with advances in other fields of urology. The recent work of Pelouze and others on the growth of the organism in the urethra, as well as studies developed from our better knowledge of the underlying pathology, etc., should warrant our assuming that treatment based on these various studies will be more productive of results in the future. In routine practice the present day urologist sees very few cases of acute urethritis. Those seen can be arbitrarily divided into two classes; the first group, merging on complete cure, and the second, those belonging to the group to be discussed.

Aside from the underlying pathology, the condition of these patients is due to preventable causes, either sins of omission or commission, or to inadequate or too drastic treatment. Sexual excess, repeated infection, neglect to continue treatment until a cure is effected, alcoholism, over-exercise, etc., indicate that the patient with a chronic urethritis in absence of visible signs or symptoms does not realize the seriousness of his condition and loses that restraining influence which is present during the active acute stage.

If we are to accomplish anything constructive in preventing the dissemination of this scourge which ranks with the major diseases in disability, we must concentrate not only on prophylaxis and rapid elimination of the gonococcus in the acute stage but realize that in education we have our most potent remedy. The foregoing conclusion is obvious when we consider the great amount of dissemination and spread that takes place during the subacute and chronic phases. The education of the diabetic is accepted as an essential element in the treatment. The training of the tuberculous patient is a recognized routine procedure. The prophylaxis of veneral disease must not end with a set of printed instructions unless they are fully explained, and in addition the patient must be given a thorough knowledge of the disease as affecting himself and his relations to others.

Definite location of the lesion is necessary to exact diagnosis and is only possible by detailed history, careful routine of physical, chemical, and microscopic examination plus urethroscopy. The elimination of a focus of infection or lithiasis higher up in the urinary tract as a cause of the cloudy urine is of primary importance. Every one here present tonight has surely had cases where a chronic discharge, specific or non-specific, was a mere smoke screen in the mind of the attending surgeon for pyelonephritis, a silent renal calculus, or a pyonephrosis. A urethral discharge in the presence of genital tuberculosis may at times present temporary difficulties in differentiation. Gonorrheal infection of the upper urinary tract may be a complicating factor. The definite presence of gonococci in the discharge or, in absence thereof, in the shreds or expressed secretion from the adnexa presents no difficulties with modern laboratory methods.

Recent research would tend to show that culturing of the organism is not the difficult task formerly ascribed to it. The definite location of the infection, whether anterior or posterior, in the prostate or vesicles is essential to the proper treatment. Symptomatology is too well known to need more than passing mention. Williams claims that the complement fixation test is positive in 75 per cent of cases of chronic urethritis. Our experience does not bear this out.

Experience has shown that the three most prevalent local causes of a chronic urethral discharge are large calibre stricture, infection of the urethral glands and follicles, and prostatitis and vesiculitis with its attendant posterior urethral infection. Palpation of the urethra will sometimes locate an area of tenderness, infiltration, or nodulation which is defined by passing a bougie a boule or is visualized by the urethroscope. Careful examination of the meatus often shows a reduction in calibre or an adventitious gland opening which can easily be destroyed by the use of the hypo-diathermic electrode. Bimanual rectal examination may show a soft globulation with enlargement or induration of the prostate and thickening of the seminal vesicles with tenderness along the line of the prostatic urethra.

The treatment of chronic urethritis is in the field of the urologist. It entails more than the use of the endoscope. It calls for many types of instrumentation and differential diagnosis for complete success. If we can learn anything from past experience in our treatment of this condition, it is that conservatism pays best. The day of drastic treatment I hope is past. It is always well to remember that the natural immunity of the patient if not broken down by our efforts at cure is one of our greatest assets, and the constitutional treatment is important in maintaining it if present, and restoring it if below par.

Our first consideration as in the acute stage is the elimination of the gonococcus when present. A natural query at this time is, how has the acute stage been handled? Pelouze, in an effort to find a solution which might be of more benefit than those ordinarily used, stated in a personal communication that he found a solution which if used for irrigation of the urethra for any length of time gave rise to a persistent discharge which baffled all ordinary efforts at eradication. In chronic anterior urethritis the use of mild antiseptics, such as permanganate, or weak silver, in the form of irrigations or instillations, have and still hold an important place in our treatment of this condition. Of the silver salts, protargol, in our hands, gives the best results. The various penetrating dyes have not lived up to their early promise. The old slogan "keep changing the injection" still holds good in these cases. They may in this way be used at times with remarkably good results. No solution should be used until it is gonococcus-fast. The clearing of foci of infection in the anterior urethra by the foregoing with dilatation and electric coagulation by means of a needle-like electrode, etc., needs no further commendation. Instrumentation of the urethra while gonococci are still present is not advisable except where a particular indication exists. The importance of the posterior urethra, prostate, seminal vesicles, etc., as well entrenched strongholds for the gonococcus has been repeatedly emphasized. The eradication or destruction of the organisms in these locations is not difficult if not overtreated locally. For this purpose more therapeutic measures have been advocated and used than in any other phase of gonorrhea. The judicious use of these will determine our success.

We are indebted to McCarthy for a series of instruments which make visual diagnosis of urethral pathology a simple and exact procedure. Because it supplied a necessity, his modifications of the Luys urethroscope when supplemented by his cystourethroscope became a notable achievement. His panendoscope presented in 1923 has made the visualization of the

urinary tract as exact as an opthalmoscopic examination. By its use and the later development of a treatment attachment, the urethra has become as accessible of examination and treatment as the vaginal canal. It is advantageous in the visualization of large calibre stricture, a pregnant cause for persistent discharge. Applying silver nitrate, tincture iodine, etc., to the posterior urethra may be done visually. Electrocoagulation of diversified types of pathology on the bladder neck, the water fall, and the verumontanum so familiar to you as urologists, is easy of accomplishment. During the past eighteen months I have painlessly destroyed innumerable excresences, polypi, etc., with my hypodiathermic electrode as a routine part of the cystourethroscopic examination. The oft repeated use of the endoscope in making applications to the posterior urethra is not advisable. The traumatism may be more injurious than the actual benefit to be derived from the treatment.

Joseph F. McCarthy and J. S Ritter, in conjunction with several others, made a series of painstaking pathological examinations of the seminal vesicles in almost four hundred and fifty cadavers. Only in one was pathology found. When we consider that over two hundred specimens obtained from the Bellevue morgue were examined and that these individuals came from the lowest strata of society, it does not seem logical to assume that none of the individuals ever had gonorrhea with complicating vesiculitis, etc. While they do not feel that the findings justify a definite conclusion as yet, they bear out the opinion of McCarthy that the causative factor in .our symptomatology of vesiculitis lies rather in an inflammatory and occlusive pathology of the ejaculatory ducts than in the seminal vesicles themselves. Only along this line of reasoning can we account for the successful efforts of Lowsley and Delzell, Young, and others in their treatment of the seminal vesicles, etc., through the posterior urethra by dilatation and injection of the ejaculatory ducts. That treatment of these structures by the use of massage, heat, electrotherapeutic measures, etc., alone is not universally successful, I believe must be conceded. That vasotomy does not yield the brilliant results claimed, except in the hands of the originators of the operations, is universally admitted. Catheterization and dilatation of the ejaculatory ducts with medication to the seminal vesicles when pathological, while not a simple procedure, is by no means difficult and is worthy of further investigation.

SUMMARY

1. Chronic urethritis is preventable in the majority of cases.

2. Chronic urethritis is essentially a urologic entity, entirely apart anatomically and clinically from its precursor, acute anterior urethritis.

3. Cure is dependent on our ability to locate infected foci, and having located them, to eliminate or destroy the gonococci, and restore tissues to their normal condition if possible.

4. Cooperation of the patient must be secured and is predicated on our imparting to him the knowledge requisite to his understanding the serious nature of his disease and its treatment.

5. The successful treatment depends on conditions and circumstances and the reaction of tissues to it, and nowhere in the realm of medicine or surgery is the maxim of Aristotle more appropriate than when used with reference to the treatment of chronic urethritis: "Not too much, not too little."

THE SURGICAL COMPLICATIONS OF GONORRHEA IN THE MALE*

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THE complications of gonorrhea in the male which may require surgical intervention occur most frequently during the acute stage of the disease. Some of them take place while the gonorrhea is still in the anterior urethra, but the most frequent and most important are those which are encountered only after the infection has become a posterior one. Of the complications occurring during an acute anterior gonorrheal urethritis, the following should be mentioned: periurethritis, periurethral abscess, cowperitis, balanoposthitis, abscess of the urethral glands and four very rare conditions, namely spongeitis, cavernitis, lymphangitis and lymphadenitis. After the urethral infection has passed the cut-off muscle, the following complications may arise: epididymitis, prostatitis, prostatic abscess, periprostatitis, periprostatic abscess, seminal vesiculitis, renal infections and the various metastatic lesions of which gonorrheal arthritis is a familiar example.

Pelvic peritonitis in the male as a result of gonorrhea is so rare that it deserves especial mention, and true gonorrheal cystitis is almost never seen.

Urethral stricture may occur either in the anterior or posterior urethra and as a result of gonorrheal urethritis, it is usually not observed until the lesion has become chronic or indeed until all clinical and laboratory evidence has disappeared.

On account of the time limit set for this paper, it is my purpose to discuss only those surgical complications of gonorrhea which the urologist sees comparatively often. The following conditions come under this heading:

1. Epididymitis
2. Prostatic abscess
3. Periprostatic abscess
4. Urethral stricture
5. Abscess of the urethral glands (frenal)

The diagnosis in most instances is not difficult. The various treatments, however, merit discussion. Most of the statistics cited as well as the various treatments described are based on observations made on the Urological Service of Bellevue Hospital during the past eight years.

Gonorrheal epididymitis occurs in about 20 per cent of male patients having gonorrheal urethritis. It is usually unilateral, though not infrequently bilateral. One attack usually predisposes to another. A swollen and painful epididymis, arising in the course of a gonorrheal urethritis, constitutes the diagnostic picture ordinarily seen. Fever is almost always present but rarely becomes higher than 102°.

When the diagnosis is not clear, nonspecific epididymitis, torsion of the testicle and the various forms of orchitis should be borne in mind. The history of the case and careful examination of the urethral smear for gonococci will usually settle these questions, though of course, where pus is present and gonococci are absent, the specific nature of the condition should not be ruled out. Here the gonococcus compliment fixation test may be of value.

In most cases, about 94 per cent, the treatment of a gonorrheal epididymitis is non-surgical. Were it not for the efficacy of this non-surgical treatment as carried out at Bellevue, many cases of gonorrheal epididymitis would certainly require surgery. Hence emphasis of the non-surgical treatment should not be out of place here. This consists in the application of an adhesive plaster suspensory bandage, which both elevates and immobilizes the scrotum. The

patient is then put to bed and kept there. This bandage and the technique of its application have been described so many times by various members of the Bellevue Urological Staff that I shall not bore you with still another repetition of its description; rather shall I bore you with only a repetition of its virtues. Suffice it to say, it is the most satisfactory method I know of which meets the two cardinal requirements of any scrotal bandage for epididymitis, namely, elevation and immobilization. I refer those of you who may not be familiar with it to the following artieles which have appeared during the last five years—"Scrotal Bandages," by C. W. Collings, *Journal of Urology*, 1922, (VII, 501); "Gonoeoccus Epididymitis," by M. F. Campbell, *Annals of Surgery*, 1927, (LXXXVI, 577); and "The Treatment of Gonorrhea," by Keyes and Jeck in the Blumer Edition of the Billings-Forseheimer Therapeusis, 1924.

In the surgieal treatment of gonorrheal epididymitis, epididymotomy as described by Hagner, is performed. This eonsists simply in opening the tuniea vaginalis and making multiple punetures with the blunt end of a needle in the affected parts of the epididymis. Pus is usually, but not always, found by this procedure. However, the immediate relief of the patient and his convalescence are not necessarily dependent on the finding of pus. If a definite abscess is found, it is drained by incision. Rarely, involvement of the testicle is such that its removal becomes a necessity.

When should the surgical supplant the non-surgical treatment of gonorrheal epididymitis? If there is a palpable abscess when the patient is first seen, of course it should be opened and drained. Otherwise the adhesive suspensory bandage is applied and the patient is put to bed. An ice bag is placed over the scrotal part of the bandage and sedatives given if necessary. Indications for operation which may then arise are: (a) pain which is continuous and severe enough to prevent sleep; (b) continued high temperature or a septie type of temperature; (e) lack of tendency of the swelling to subside after two to four days have elapsed; (d) fluetuation, indieating abscess. Of the foregoing, pain has, in our Bellevue experience, been the most reliable eriterion for operation, and is immediately relieved thereby.

As an objection to epididymotomy the plea is advaneed that sterility oecurs more frequently than it does in the non-operative ease. But there seems to be insufficient data to justify this attitude.

The average hospitilization period for the patient on whom epididymotomy is performed is about 4 days longer than the average hospital stay of the patient treated by the adhesive suspensory bandage and rest. However, epididymotomy, if done early enough, may not only save the epididymis but the testicle as well. Epididymeetomy may be necessary in those few instanees where epididymotomy has been deferred too long or in eases of constantly relapsing epididymitis.

Prostatic Abscess. It is not always a simple matter to tell when a gonorrheal prostatitis has advanced to the stage of definite abseess formation. Fever, pain and acute retention may all be common to both eonditions. Or, as it rarely happens, and quite paradoxieally, both fever and pain may to some extent subside or disappear entirely as the abscess develops. Usually, however, the fever and pain increase and if the acute retention persists for more than forty-eight hours, a suspicion of abscess formation is warranted. Rectal digital palpation usually confirms the diagnosis. The prostate is found to be greatly enlarged and, as a rule, exquisitely sensitive. A boggy softening or definite fluctuation ordinarily leaves no doubt in the surgeon's mind as to the true condition but in many instances the diagnosis should be made on the intensity of the symptoms alone plus the eontinued retention before fluctuation ever develops.

The treatment of prostatic abscess will be briefly discussed in connection with the

third important gonorrheal complication, namely, periprostatic abscess.

Periprostatic Abscess. The same symptoms and signs of the foregoing condition may, and usually do, apply here. Usually where there is a periprostatic abscess there is also a prostatic abscess but the converse proposition is rarely true. The diagnosis is established by means of rectal digital palpation. Instead of the well-outlined, smooth rounded mass of the prostatic abscess, one feels a boggy inflammatory condition, usually irregular in shape extending to one or both sides of the pelvis, with a tendency also to extend forward. Tenderness is, as a rule, extreme and fluctuation is often present.

The treatment of prostatic and periprostatic abscess may be summed up briefly as follows:

For prostatic abscess, the "sound" operation.

For periprostatic abscess, perineal drainage. As a rule this should be extraurethral, but if the integrity of the urethra is threatened by the proximity of the abscess, then the urethra is opened as well and a drainage tube inserted into the bladder.

For both prostatic and periprostatic abscess, perineal drainage, either extra or intraurethral.

In a paper entitled "Operative Treatment of Prostatic Abscess" presented before this section in March, 1927, by Dr. A. R. Stevens, the "sound" operation for prostatic abscess was described in detail and statistics were given in support of its popularity with us at Bellevue. These statistics deal with the operations for prostatic abscess on the Bellevue Urological Service during the past eight years and are now brought up to the present time:

"Sound" operations, 84. Thirty-eight of the patients remained in the hospital after operation five days or less. The average post operative stay in the hospital was a fraction over seven days. There were two postoperative deaths.

Perineal operations, without opening the urethra, 15. Average postoperative stay was eighteen days.

Perineal operations through the urethra (external urethrotomy), 13. Average postoperative stay, thirty-four days. No deaths followed either perineal operation.

Urethral Stricture. The symptoms and diagnosis of stricture are so familiar to us all that I shall forego presenting them. However, it is well to remember that occasionally a patient, into whose bladder not even a filiform may be passed, will after complete anaesthetization take readily a sound of large calibre.

The treatment of urethral stricture may be summarized as follows:

Strictures of the pendulous urethra almost always, strictures of the deep urethra almost never, require urethrotomy. When urethrotomy becomes necessary, internal urethrotomy is the operation of choice in stricture of the pendulous urethra, while either internal or external urethrotomy may be performed in strictures of the deep urethra. In both instances, the criteria of urethrotomy are the presence of complications in the nature of dense infiltrations or periurethral abscess.

In uncomplicated stricture of the pendulous urethra, dilation by sounds may first be tried. When relapse which is almost certain to occur takes place within a week or two after dilation, then the stricture should be cut.

The complications of deep stricture necessitating urethrotomy are periurethral inflammations, such as cowperitis, abscess, and phlegmon. In these instances, of course the incision should be made through the perineum and usually, especially in phlegmon, with an unsparing hand. In the latter complication, aside from cutting the stricture, multiple free incisions into all the infiltrated tissue with actual debridement of the skin and subcutaneous structures when gangrenous, are necessary to prevent further spread of the infective process.

The maxim, "once a stricture, always a stricture," though perhaps not literally true, should be kept in mind both by the

patient and by the surgeon. For whether the primary treatment of a stricture is by sound or operation, the treatment does not end there. In fact this is but the beginning. The passage of sounds must be continued indefinitely (perhaps for the remainder of the patient's days) at intervals sufficiently short to permit of no relapse.

A fairly common and often troublesome complication of gonorrhea is

Abscess of the Urethral Glands. The gland in which an abscess most frequently develops is situated in the neighborhood of the frenum. When involved if it is grasped between the thumb and index finger, it feels almost like a buck-shot which has been buried in the tissues, and is frequently noticed first by the patient himself. When seen by the surgeon, it often explains remissions in a urethritis which otherwise progresses satisfactorily.

The abscess communicates with the urethra by means of the small duct through which the infection gains entrance. Later on, it usually breaks through to the outside, but as a rule neither the external nor the internal communication is sufficiently large to permit of proper drainage. Imagine then, if you will a state of affairs which, when represented graphically, may be compared in shape to a minute Coolidge *x*-ray tube. The dilated middle portion of the tube represents the abscess, while one of the narrow ends is a fistula of exceedingly small calibre running into the urethra and the opposite narrow portion another minute fistula with its exit close to the frenum.

The diagnosis is made by the palpation of the small shot-like mass, which is moderately tender on pressure and situated just underneath the frenum.

Treatment: Incision into the abscess pocket, from without in. The incision should include the outer fistula and the outside opening should be somewhat longer than the diameter of the abscess itself.

SUMMARY

In acute gonorrheal urethritis, the surgi-cal complications fall chiefly into two groups, those of the pendulous urethra, and those of the deep urethra. Of the first group the chief complications are periurethritis, periurethral abscess, cowperitis, balanoposthitis, abscess of the urethral glands, spongeitis, cavernitis, lymphangitis and lymphadenitis. Of the second group should be mentioned: epididymitis, prostatitis, prostatic abscess, periprostatitis, periprostatic abscess, seminal vesiculitis, renal infections and the various metastatic lesions. Urethral stricture is common to both groups. Pelvic peritonitis and gonorrheal cystitis are both extremely rare.

The following complications, which are those most frequently encountered, are the only ones discussed:

Gonorrheal epididymitis may at times be confused with non-specific epididymitis, orchitis or torsion of the testicle. Treatment is surgical (epididymotomy) in six per cent of cases. Non-surgical treatment consists of a properly applied adhesive plaster suspensory and rest in bed.

Prostatic Abscess and Periprostatic Abscess. Exquisite tenderness which persists, acute retention and fluctuation are the main diagnostic points. If the abscess is wholly within the prostate, the "sound" operation is indicated. If the abscess is periprostatic or both intra and periprostatic, open operation (extraurethral) through the perineum should be done. External urethotomy is performed only when the pathological process involves the urethra.

The diagnosis of *urethral stricture* may be erroneously made if the patient fails to relax and cooperate with the surgeon. The mistake in diagnosis is not discovered until proper relaxation is had by means of an anaesthetic.

Uncomplicated strictures of the pendulous urethra almost *always*—uncomplicated strictures of the deep urethra almost *never*, require urethrotomy.

Abscess of the urethral glands (frenal) requires free incision from without in—not by intraurethral approach.

THE TREATMENT OF GONORRHEA IN THE FEMALE*

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DURING the last two decades there certainly has been a great diminution in the number of cases of infectious diseases including the exanthemata; in fact it has become an axiom that every community can prevent a typhoid epidemic by tracing its cause to the source. Only twenty years ago every hospital ward throughout the country contained its quota of typhoid cases but today they are an unknown entity with the exception of sporadic epidemics; the treatment was prophylactic and preventative. Serology rendered immunology, and prophylaxis prevented its propagation. The same can be said of diphtheria. Prophylaxis through the field of serology is saving thousands of children that otherwise would have gone to their untimely end. Diphtheria and typhoid are diseases which follow the wake of nutritional necessity. We must breathe to live, and in the process of respiration we contract a disease of which diphtheria is a biproduct. We must satisfy thirst and hunger and in the process of digestion typhoid is but a biproduct.

In order to discuss intelligently the treatment of gonorrhea, whether in the male or female, we must be able to draw a sharp contrast between a venereal disease and one that is contracted in process of our nutrition. Gonorrhea, while an infectious disease contracted in 99 per cent of all cases outside of childhood, through the act of venery, becomes one for discussion on the ground of preventability for it is contracted not during the process of necessity but one of choice. I am endeavoring here to drive out into the open a disease which we can view from all sides and the first astounding feature is that as we have attempted to treat it or eradicate it we have done so under cover. It is a disease contracted in the private walks of our life and not in the public market place where we have flaunted our air of respectability. It is of necessity a biological disease. Let me illustrate. A species of tropical fly can carry within its own protoplasm another organism which if implanted into another living organism can produce a disease capable of destroying an army. The same can be said of the gonococcus; it is an organism whose habitat may be the male or female human being and lie dormant for indefinite periods but once implanted into another human being rehabilitates its own vitality and makes its inroads into the health of its new receptor.

This suggests to us that with the implantation of this microorganism there must be various phases of the disease produced which are the acute or productive stage, the subacute or subsiding stage and the chronic or the dormant stage. The treatment of these various stages in the female must invoke specific methods such as hygiene and sanitation, medical and surgical procedures, serum and vaccine therapy, electrothermal and prophylaxis.

My own experience in the treatment of gonorrhea in the female has taught me that adherence to the technique of treatment has been far more beneficial than a variety of methods, and that antisepsis as a principle is more valuable than a variety of antiseptics.

All acute cases are preferably put to bed for seven to ten days. Alkaline douches mechanically remove the discharge and the organisms that lie in the vagina, lessen absorption of toxins, and have a tendency to lessen reinfection.

The physician's treatment of the patient

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295

for a week or ten days daily, and then every other day throughout the course of treatment, consists in swabbing the cervical canal with a cotton applicator dipped in one of the following solutions: 10 per cent argyrol, 2 per cent silver nitrate, 1 per cent acriflavine or 2 per cent mercurochrome. On the same occasions 10 per cent argyrol or 1.2000 acriflavine or 1 per cent mercurochrome is instilled into the bladder. If the urine contains pus, the instillation is preceded by irrigation with normal boric acid solution. The patient is instructed to give herself the following treatment at home: one dram of 10 per cent argyrol or 1 per cent mercurchrome is injected into the vagina by means of a glass McElroy male urethral syringe while the patient is lying upon her back in bed. A thick guard is applied and the argyrol or mercurochrome is retained all night if convenient. The next morning she takes a cleansing alkaline douche, and after breakfast argyrol or mercurochrome is again instilled into the vagina, retained for an hour and douched out. For an hour after lunch argyrol or mercurochrome is kept in the vagina and then removed by a douche.

At bedtime argyrol or mercurochrome is placed in the vagina for the night as before. The patient is directed to occupy a bed by herself, and not to engage in coitus till she is pronounced well. Fluids are forced, as they aid in the elimination of toxins and help to remove pus.

Stubborn cases in non-pregnant women have been treated with a few drops of 10 per cent mercurochrome carefully instilled into the cervical canal by means of a curved pipette to which has been attached a medicine dropper bulb, and the results have been surprisingly good.

Pemberton adds that the treatment of the urethritis is about the same, although nothing active is done during the early stage of the disease. As urination is painful, sandalwood oil in ten minim doses three or four times a day seems to have a soothing effect. After the acute symptoms have subsided, 1 per cent mercurochrome solution is injected into the urethra at the time the other treatment is being given, taking care to inject only about two cubic centimeters of the solution, to avoid carrying the infection into the bladder, and the lining of the urethra must not be injured.

In chronic gonorrhea in women, a recent German writer (Loeser) has employed the vaccine treatment. Not earlier than eight weeks after the acute stage he injects intramuscularly a vaccine made from the first or second passage of gonococci. The first injection should contain 300,000-000 germs, and he gives six to eight increasing doses at intervals of three or four days. If this does not improve the condition, to continue is useless, and in such cases he gives a single subcutaneous injection of 0.5 c.c. of a suspension of a living culture. The injection produces a swelling but within a week the gonococci have frequently disappeared. The author says the treatment is useless in open gonorrhea.

In Johnson's recent brief report on mercurochrome in the treatment of gonorrhea in women, he cites a case in which expert examination found gonococci in smears from the urethra, introitus vaginae, vaginal vault and the cervix uteri. The patient was told to take a douche of warm water on retiring, then with the index finger protected with a rubber cot, she pushed a 2 per cent mercurochrome suppository up into the Douglas pouch. This she repeated every night for fourteen, wearing at all times a napkin.

Ten days after this series of treatments smears from the urethra introitus vaginae, Douglas pouch, and cervical canal, all proved negative. This was repeated twice with an interval of seven days between the examination of smears, and on both occasions the smears were found negative. All the symptoms disappeared and have not returned. The author, while not claiming to cure gonorrhea with mercurochrome, says that it thoroughly penetrates

the lining structures of urethral, vaginal and cervical membranes and frees these parts of the gonococci, also causing the symptoms of the disease to disappear.

The application of the electric cautery to the treatment of gonorrheal endocervicitis offers two distinct advantages over the older, more haphazard methods. First, it provides a means of curing the irresponsible patient who will not cooperate in her own treatment; seconds, it affords the physician a method of curing the conscientious sufferer.

Shutter describes his technique of cauterizing the cervical canal as follows: "The application of the cautery to the canal of the cervix is seldom painful and is usually done without anesthesia. A small nasal tip cautery is introduced into the cervix as far as the internal os, the current is then connected and the tip is gradually drawn outward. One or two such strips are made at a time, an effort being made to confine the application to one or two sides of the canal. Little or no pain is felt unless the heated instrument comes in contact with the vaginal mucous membrane. The extent of the cauterization at any one time depends on the ease with which it is borne by the patient, the chronicity of the infection, and the relation of the time of treatment to the menstrual cycle. From two to four treatments at intervals of from ten days to two weeks are usually given. This repeated application of heat in the canal is a factor in the result, as it kills the bacteria in the glands. Nabothian follicles and erosions respond rapidly to treatment. When anesthesia is necessary in giving treatment an effort is made to complete the cervical cauterization at one time. If this is done, the patient is confined to bed afterward, and to date no bad results have occurred. Immediately following treatment the cervical discharge is profuse. Bleeding for several days after cauterization is common but not severe, and patients should be informed of this possibility. Vaginal douches are not given in the first few days following treat-

ment. As a rule, cervical secretion is scanty by the sixth week after the last cauterization."

Diathermy is strongly advocated by various writers for the treatment of gonorrhea in women. Corbus and O'Conor, in their latest article on the subject, describe and illustrate in detail their technique for the application of this method of heat treatment of gonorrheal endocervicitis. They call attention to the fact that it has been demonstrated that the gonococcus is instantly destroyed at a temperature of 113°F., or at 104°F. prolonged for from six to eight hours. And since the normally nourished epithelial cell can survive a temperature of 118°F. for one hour, and connective tissue cells even higher temperatures for longer periods, the reason of the therapeutic possibilities for destroying the gonococcus within the living tissue by heat is manifest.

In order to insure success with diathermy in gonorrheal endocervitis, the authors state that it is necessary to have a satisfactory high-frequency machine; the method of conveying the best radiation (with an active and an inactive electrode) should be properly designed and adjusted; and the time of application of the heat radiation, which is at a temperature of 116 to 117°F., should be not less than twenty-five minutes, and may extend as long as sixty minutes, with a varied reduction in temperature.

Walther employs diathermy in treating endocervicitis, and instead of excising Batholin's ducts and Skene's glands, when they are infected, he uses the same modality for cauterizing them. By the insertion of a blunt-tipped needle electrode into the duct, both the Batholin duct and its gland can be sterilized in a few seconds, and the after care consists of topical applications of a 10 per cent mercurochrome solution.

To sterilize Skene's glands the diathermic needle is employed through the electric skeneoscope. Usually one gland is treated at the time because of reactionary

edema which follows high frequency cauterization here. Within three days or a week the other gland is sterilized in the same manner under local anesthesia.

Surgical treatment of gonorrhea in the female has not changed materially in the past twenty years except probably toward conservatism. A greater lapse of time has been given between the onset of developing of salpingitis and the period of operative procedure. The time ordinarily allowed to produce a chronicity and a complete walling off together with the production of sterility on the part of the gonococcus has greatly lessened the mortality and postoperative morbidity. During the preoperative stage there has been to my mind great constructive advances in protein therapy. While I believe that it is rash for men to say that a pyosalphinx will disappear under milk injection there is no doubt that the fulminating hydro-pyosalpinx can be reduced by physiological absorption through the medium of protein injection. Gelhorn is optimistic enough to say that 30 or 40 per cent of the operative cases will evade the operating table by the milk injection. Rawlings who has contributed liberally to our information by foreign protein treatment takes the attitude that patients are much safer undergoing an operation than those not so treated. My own experience has shown that milk injections following surgical interference aids rapidly in the absorption of tissue where there has been parametric thrombosis. Gonorrhea is different from syphilis in that the latter is a protean disease as only 7 to 10 per cent of gonorrheal infections become hematogenous in character.

The prophylactic treatment of gonorrhea to my mind affords the most hopeful avenue of approach through the medium of education and police power. If we wish to plot a curve of the number of cases of gonorrhea in both sexes, two years previous to the war it would be almost astounding to watch the drop in the curve between 1917 and 1920. This was the result of police power and education. The army and navy tackled the venereal problem with its police power and viewed the disease as a biological one. Just as they have instructed their men not to drink any water except that which was boiled, likewise they made imperative the reporting of all coitus in order that prophylactic measures could be given early.

This leads me to believe that if our health powers, municipal authorities and sectarian bodies would offer to the public through channels of education the same opportunities as offered by the militia our plot curves would not have gone up as they have done from 1921 to 1926. I am still radical enough to believe that when we teach the dangers of contracting gonorrhea as we do typhoid and diptheria in academic institutions we will more nearly approach the millennium of health.

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THE ROLE OF THE GONOCOCCUS IN STERILITY*

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THE gonococcus itself plays no role in sterility either in the male or female. There is absolutely no antagonism either between the gonococcus and the spermatozoon or the gonococcus and the ovum. A man suffering from an acute gonorrheal urethritis may impregnate his wife and infect her with gonorrhea at the same coitus. In other words, there may pass through a urethra harboring gonococci, semen containing live spermatoza without the vitality of the latter being diminished in any way. This fact, while known clinically, was definitely proven by me experimentally over 14 years ago,[11] when I mixed up on a slide semen containing live spermatozoa with virulent gonorrheal pus, without noticing any diminution or change in the activity of the spermatozoa. In the female we find the same conditions. A woman suffering from gonorrhea may become impregnated and bring forth offspring. Cases are on record[2] where women suffering from acute gonorrheal purulent salpingitis, have been impregnated, showing that the gonococci have no detrimental effect either upon the ovum or the spermatozoon. Even prolonged contact between gonococci and spermatozoa does not appear to hurt the latter.

How then does the gonococcus become the important factor in the production of sterility in both sexes? It is only by causing pathological changes in the male and female genitalia that this dire consequence is produced. To be systematic, I will now, in the short period of time alloted me, discuss the effect of the gonococcus on the various sex organs in the male and female.

Let us start with the male, commencing with the testicles, the source of production of the spermatozoa. It is perhaps not generally known that the gonococcus produces at times changes in the spermatogenic function of the testicle. This has been demonstrated by me in a few cases where I aspirated the testicle in persons suffering from acute gonorrhea.[11] I have found in patients who had borne several healthy children, and who have subsequently become infected with gonorrhea, that upon aspiration no spermatozoa could be demonstrated in the aspirated testicular fluid. In other cases, however, spermatozoa could be demonstrated, showing that the gonococcus will in some cases for the time being destroy the testicular function of the testicles and in others not. My experiments, however, in this class of cases are very few in number, and more extended experiments in aspiration of the testicles may perhaps determine definitely just what occurs.

It is in the epididymis that the most damage occurs, as regards male sterility. Here again it is to be noted that it is not the gonococcus itself, but the inflammatory reaction caused by the gonococcus, mechanically occluding both epididymi, which causes the sterility. This fact is so generally well known that it is not necessary for me to dilate upon it any further. There is one caution, however, in this regard which I have brought out in some of my previous publications,[15,16,17,18] and that is, that we may have a combination of occlusion of the epididymi and absence or destruction of the spermatogenic function of the testicles so that, before operating upon such occlusion, we must determine by aspiration of the testicle whether spermatozoa are present in order to avoid needless operation.

We next come to the vas deferens.

Here again we may have occlusion just as in the epididymis, and everything I have stated regarding the epididymis applies to a certain extent to the vas. In addition I would like to call attention to a form of vasitis, to which I have frequently called attention in many of my publications,[13,16,17,18] but which has not yet found its way into many of our excellent genitourinary textbooks. I refer to cases in which during gonorrhea there occurs such a slight inflammation of the vasa that no clinical evidences of it is noticed during the gonorrhea or thereafter, but the inflammation is sufficient to occlude both vasa, causing absolute sterility. In these cases there was never a clinical history of an acute epididymitis, and there are never later found the thickenings which are characteristic of a previous epididymitis, yet condom specimens show absolute azöospermia, while aspiration shows spermatozoa in the aspirated testicular fluid. This definitely demonstrates that the cause of the sterility is not in the testicle nor in the epididymis, but in the vas. This conclusion can only be arrived at by aspiration of the testicle.

Coming next to the prostate and seminal vesicles, we again find no antagonism between the gonococci and spermatozoa. It is a well known clinical fact that a patient may be apparently cured of his gonorrhea, and still harbor gonococci in his prostate and seminal vesicles. It is just these cases, as is so well known, that are so tragic in producing gonorrhea in the bride after the husband had honestly thought that he was perfectly well and safe; and generally such husbands will not be sterile, though harboring gonococci in the prostate and seminal vesicles. This illustrates that even prolonged contact between gonococci and spermatozoa do not injure the latter. It is this condition which is generally supposed to be a frequent cause of one-child sterility. Moreover, in attempting to determine whether a patient is cured of his gonorrhea, condom specimens have been submitted to culture for gonococci, and it is not unusual to find gonococci present on culture in a condom specimen showing normal lively spermatozoa. It is of course possible, and probably does occur at times, that necrospermia results from a gonorrheal seminal vesiculitis, but here again it is not the gonococci, but the altered seminal secretion which causes the death of the spermatozoa. Just exactly to what extent necrospermia is due to this condition has not as yet been definitely determined.

We next come to the ejaculatory ducts and their openings in the posterior urethra. Theoretically, the same occlusions which occur in the tubes higher up may also occur here. Practically, however, since the modern procedure of catheterizing the ejaculatory ducts through the modern urethroscopes, and also injecting them for purposes of roentgen-ray examinations, it has been demonstrated that sterility is very rarely due to occlusions here. When I say very rarely, I mean in proportion to the other causes. Moreover, in cases of occlusions very low down, there would also be aspermia (absence of any ejaculation) which is indeed a very rare condition.

Coming now to the last anatomical division, namely the urethra, both anterior and posterior, we find that it plays very little role in the etiology of sterility. As before mentioned, the urethra may harbor an untold number of virulent gonococci without killing the spermatozoa. In order to make this portion of the discussion complete, I might say that in very bad cases of stricture of the urethra, ejaculation may be so interfered with as to become a factor in the production of sterility. But this again is a very infrequent factor in sterility, as it must be a very bad stricture to materially hamper ejaculation, and even in some of these cases, though perfect ejaculation does not occur, the semen may dribble out of the meatus after the penis has resumed its flaccid condition and impregnation may occur.

In concluding the discussion of the role of the gonococcus as a factor in male sterility, I may mention the fact that gonorrhea · is very rarely the cause of impotence in the male, and so plays but a very minor part in the production of sterility in this manner. I have frequently remarked that I have often been tempted to wish otherwise, for if gonorrhea were frequently a cause of impotence, and this fact were generally known, it would not only limit the spread of the infection but would be a most powerful deterrent of illicit coitus. As a matter of fact, impotence itself, no matter from what cause, does not necessarily cause sterility.

In the female we may say generally that the main pathological conditions caused by the gonococcus, which are the most important factors in female sterility, are found in the cervix and in the tubes. Owing to its histological structure, the adult vagina does not harbor gonococci for any length of time. Those cases in which gonococci are frequently found have been definitely proven to be due to continuous reinfections, either from a gonorrheal cervix, or from cohabitations with an infected partner. Even in these cases the vagina plays but a minor role because, barring exceptions, it is only those spermatozoa which are ejaculated directly on the cervix during coitus that cause impregnation. Even in normal cases the spermatozoa which linger but a short time in the vagina are quickly killed off by the vaginal secretions.

In the cervix, however, the gonococci very often set up a purulent endocervicitis which so alters the normal cervical secretions that the spermatozoa are either killed or become entangled in the mucus and are unable to make their way upwards. In performing the "Huhner test" shortly after coitus, it is very interesting to note under the microscope live spermatozoa in the cervical mucus, but these do not dart freely about the field as in normal cases but are stuck either by their heads or tails in the mucus, the free parts wig-gling about in their frantic efforts to disentangle themselves. I would especially emphasize, however, that this condition is not pathognomonic of gonorrhea, as other forms of endocervicitis may have a similar effect on the spermatozoa.

While gonococci have been found in the fundus uteri, especially by Curtis,[5] in the vast majority of cases in which they were found the patient had been regularly exposed to reinfections. As a matter of fact, Norris in his great book "Gonorrhea in Women" says that while gonorrheal endocervicitis is very common, gonorrheal endometritis is a very rare condition. It has been supposed that gonorrhea so alters the uterine endometrium that it becomes unfavorable for the nesting of the impregnated ovum; nevertheless pregnancy has occurred in the presence of a severe, purulent gonorrheal inflammation of the decidua.[2]

It is in the tubes, however, that the gonococci cause pathological changes which are a profound factor in sterility. Here again I would emphasize that it is not the gonococcus itself, but the pathological changes in the tubes which it causes that produce the sterility. As mentioned at the very commencement of this paper, pregnancy has occurred in the presence of an acute gonorrheal purulent salpingitis, showing that neither the ovum, nor the spermatozöon, nor the impregnated ovum are destroyed by myriads of gonococci. As a matter of fact, however, the gonococcus disappears with comparative rapidity from the tubes. It has been previously supposed that gonococci remain for indefinite periods in the walls of the Fallopian tubes though disappearing rapidly from the lumen of the tube. Curtis,[7] however, has proven that even in the walls of the tubes they do not linger for any length of time. He made cultures of over two-hundred pairs of thoroughly ground Fallopian tubes and found that it was hardly ever possible to obtain the gonococcus longer than two weeks after the disappearance of the fever and leucocytosis. As a result of his experi-

ments he has come to the conclusion that gonorrheal salpingitis is essentially a self-limited process, and that persistent active gonorrhea of the Fallopian tubes is attributable to recurrent infection rather than to chronic infection, and that, with re-infection prevented, the Fallopian tubes should heal spontaneously.

As is well known, the pathological changes in the tubes caused by the gonococcus result in either a complete closure in both tubes or a change in the epithelia of the tubes or their fimbriated ends, mechanically preventing either the ovum from descending or the spermatozoa from ascending. The closure of the tubes can be demonstrated by the Rubin test. This test is so well known that it is not necessary to describe it before an assemblage like the present. There is one point, however, which I wish to emphasize and that is that the test should be performed in *every* case of female sterility, irrespective of the history, for it has been demonstrated over and over again that the tubes may be occluded in women in whom there has never been even a suspicion of gonorrhea.

Coming finally to the ovaries, we may briefly reiterate that here also it is not the gonococcus itself but the pathological changes brought about by it which causes the sterility. As a general rule, it is only when there has been produced a productive inflammation that completely imbeds the ovaries in masses of adhesions or causes such thickenings of its tunica as to mechanically interfere with ovulation, that sterility due to gonorrhea results.

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Discussion

Dr. N. Lapowski, New York: The biological aspect of the gonococcus is seen in the arrangement of the papers constituting this symposium. We note that a patient under treatment for an anterior urethritis is liable to complications and a spread of the trouble and, as a result, may be transferred to several physicians, from the surgeon to the cardiac specialist.

We know that the gonococcus is immobile and extension is caused by trauma or active physiological functions; among the latter I may mention coitus, menstruation, pregnancy and mechanical manipulation by a physician.

To destroy the gonococcus on the surface is the abortive treatment, but not the treatment of anterior gonorrhea. To abort an early acute case the superficial and deep gonococci must be reached. For thirty-five years I have heard of remedies that would accomplish this destruction but as each newly advertised remedy is found wanting a new one takes its place. Of all the remedies and methods we have, to my mind, the best, at the present time, is diathermy. This, because it reaches deeply and by the rise in temperature produced in the tissues destroys the gonococcus. But it must not be used in the urethra as the mucous membrane may be affected by the burn which may be easily produced.

We must remember that the gonococcus may keep its vitality after application of a temperature of 115° F. As to its longevity, it has been found in a vital state forty-nine and fifty years after the primary infection. It resents injuries. Its motto is "J'y suis, J'y reste," meaning, "Here I am and Here I will remain." Still there are physicians who claim they can cure gonorrhea, but they forget that it is spread every night.

We know very little of the physiology or biology and surely nothing of the pathology of the spermatozoa.

The best method to follow in treating gonorrhea is not to use injections, but treat it as you would any other inflammatory condition. By this method many surgical complications will be avoided. I am sure that surgical complications are observed more often in the overtreated case than in the undertreated one.

A SIMPLE DEVICE FOR FACILITATING RECTAL OPERATIONS

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WHEN operating upon the rectum of a male patient in the dorsal lithotomy position, the proper retraction of the scrotum and penis becomes a problem. To meet this problem there have been devised, of course, various contrivances. Perhaps the one which is most

RECTAL DRESSING BELT

FIG. I.
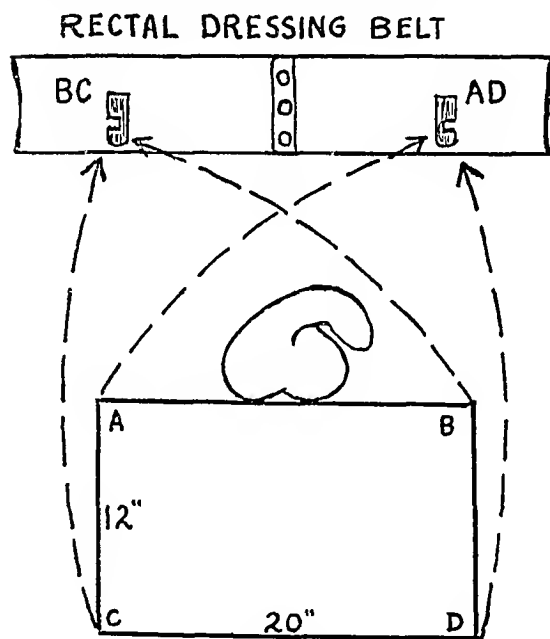
generally used is that of a folded towel moistened with bichloride solution. The middle of this is placed under the scrotum and the ends of the towel laid into the groins. Having no definite attachments the position of the towel is not infrequently shifted. The scrotum being thus left unsupported comes tumbling down on to the perineum in a most exasperating manner.

To avoid this divergence from efficient technic the device I now mention was developed. It consists merely of a piece of plain muslin 12 × 20 inches. This is saturated in a bichloride solution and then wrung out. The manner in which it is attached constitutes the entire "trick" of the device. This may be briefly described as follows: Before going to the operating room the patient is equipped with a perineal dressing belt such as I described in the Journal of the American Medical Association June 1926, (LXXXVII, 30) under the name of "An Improved Rectal Dressing Binder." It consists of a broad elastic belt upon which are fastened flat clasps as shown in the diagram. After the patient is anesthetized and his legs are put up in the stirrups the aforementioned muslin kerchief is applied as follows: corner A is fastened onto clasp AD and corner B is fastened onto clasp BC. The edge of the muslin AB is then adjusted by suitable tightening so that the base of the scrotum and penis are entirely enclosed therein. When such adjustments have been satisfactorily made, the lower edge CD is folded up over the scrotum and the corners C and D are fastened on to clasp BC while corner D is held by clasp AD. Thus it is evident that the upper corners of the muslin kerchief are attached to clasps on opposite sides while the lower are attached to clasps on the same side.

When the device just described is used one may proceed with absolute confidence that neither the operative field nor his peace of mind will be disturbed by the sudden intrusion of the genitourinary department into a strictly proctological procedure.

SURGERY: ITS UTILITY IN PHTHISIS*

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THE indications in the treatment of pulmonary tuberculosis are, first, to place the patient in surroundings most favorable for the maintainance of a maximum degree of nutrition; second, to take such measures as in a local or general way, might influence the tuberculous processes, and third, to alleviate symptoms. These indications were set forth by Osler more than thirty years ago and they still point the way to those who would lend a hand to these people. It would appear, however, that these indications have taken on a different significance. Heretofore, surroundings have referred more to location; today surroundings signify relief from environmental pressure, both external and internal; measures taken to influence the tuberculous processes have referred to tuberculin or specific drugs; now they suggest, more especially, surgical procedures; measures taken to alleviate symptoms implied the use of drugs; now they mean the employment of functional rest, both local and general.

In the present-day treatment of phthisis these three indications, now commonly accepted, are followed but in their new significance. The promotion of a state of nutrition at the expense of digestion and assimilation is not advocated; the continuation of bed-rest in the absence of evidence of active disease is not advised; the postponement of steps to anticipate the effects of sinister influences (physical defects, pathological conditions, focal infections) is considered not wise. Granted that these people are doomed to a life of invalidism or to premature death unless assisted, it would seem necessary, if they are to be rescued, to undertake constructive rather than palliative efforts in their behalf.

Therefore, the end in view in the modern management of phthisis is not to make the patient fat and strong and leave the lesions in the lungs to take care of themselves; the end in view is to make the tissues of the body clean with respect to infection and to make it possible for all the tissues of the body to function physiologically. As it is not possible to accomplish these desirable conditions except through the application of surgery, its utility in this chronic affliction is apparent and is becoming more evident every day as the limitations of medicine are appreciated. Surgical intervention is not only essential to but also is, rational medicine.

Our confidence in surgery to influence favorably tuberculous processes in the lungs and thereby to prolong some lives with usefulness, is based upon certain conceptions of physiology and pathology. To some of these we would invite your attention at this time, as well as to the merits of the two surgical procedures—pneumothorax and multiple costectomy—with which we have had some experience.

With respect to the physiology of the lungs, we will consider first, the fact that the lungs are in a state of tension within the thorax. They fill out the thoracic cavity because the visceral pleura and the parietal pleura have always been in apposition; they grew that way. The lung tissue itself, takes up but very little room; most of the space is taken up by air. How the air gets in, is a matter about which there is difference of opinion. The point

which we wish to make is that whenever circumstances permit it, the lungs will recoil just like a piece of elastic, and a certain amount of contraction ensues which involves one lung at first but later both lungs are relatively affected.

If these observations are true, we may appreciate what happens when the volume of the thorax is reduced by surgical methods. The healthy lung tissue as well as the diseased tissue, contracts; the healthy tissue contracts the most at first, but sooner or later it begins to expand while the diseased tissue remains contracted. As a result the various lesions become surrounded by tissues in a state of contraction or relaxation but differing in degree: the tissues immediately about the lesions are in a state of complete functional rest, those more remote are in a state of relative inactivity, while those farther away are in a state of comparatively normal activity.

Another conception which we regard as pertinent is atelectasis. Atelectasis is a phenomenon seen to the best advantage at birth just before respiration is initiated. The mechanism for the exchange of gases—oxygen and carbonic acid—is all set to go but two most important factors—blood and air—are lacking. The so-called "secondary circulation" has not yet become established; the walls of the tubular structures and alveoli are still in apposition. A roentgenogram of the chest of a still-born child shows only a homogenous shadow in which no organ, not even the heart, may be made out. When the Eustachian valve closes and the pulmonary circulation gains momentum, the lung tissues become rigid, the walls of the bronchi and alveoli are forced open and air enters simultaneously through the upper respiratory passages. (Thus does man begin his pansophic career.)

Atelectasis of both lungs occurs only at birth, but some atelectasis may occur during life, in one or both lungs. The amount present depends upon the depth of respiration. Atelectasis observed in life is known as functional atelectasis. Func-

tional atelectasis may be regarded as a conservative event; it is the natural way for the lungs to rest. In the presence of injury or disease, some of it may be observed immediately about the parts affected where it appears to act as a buffer between the tissues injured and those actively functioning. It apparently serves to protect the former from interference and to preserve about them the most favorable conditions for healing.

Now the great similarity between contraction of the lung and functional atelectasis should be appreciated. The difference, if there is any, is apparently in the position of the lung; when it contracts, it recoils toward the mediastinum; when it enters into a state of functional atelectasis, partial or complete, it collapses in the direction of the chest wall. In other words, contraction of the lung and functional atelectasis are the same in affect.

If these observations are true, then contraction of the lung or functional atelectasis, or what Alexander calls "physiological amputation of the lung," should be promoted in the presence of disease for several reasons; first, because it is highly desirable to secure as complete rest as possible to the diseased tissues; second, because it is well to secure about the parts affected an ample barrier of defunctionalized tissue, lest the processes of defense and repair be disturbed; and third, because lung tissue in a resting state, probably offers greater resistance to the further spread of the process; it tends to localize the effects of the disease.

Still another physiological conception which seems to us to be relevant is that healthy lung tissue is best accomodated in the space nature made for it.

If this observation is true, it follows that healthy lung tissue should not be permitted to expand into, nor be forced to work in, a space larger than is normal for it. Under such circumstances it would be embarrassed and it is likely that the individual would be inconvenienced; for the threshold of his respiratory comfort

would be lowered. It would seem advisable therefore, when a tuberculous process has produced tissue destruction, to reduce the volume of the thorax commensurately so as to anticipate the compensatory alevolar hypertrophy required to fill the space left by the tissue destroyed.

Now if these observations are pertinent as well as true, the application of surgical measures, such as pneumothorax and multiple costectomy should be applied upon physiological rather more than upon pathological considerations. If they will accomplish the effects which we have tried to describe, they should be used ere the processes have become widespread, not only for the good that they may do but also for the harm that they may save. The remediable forces of nature alone might cure a very large number of those having an experience with tuberculosis, if they would only give their cooperation intelligently and indefinitely. But experience proves that the majority of patients are in too much of a hurry; they may submit to discipline for a while but ere long they want to be set free; they want to go and do what other people are doing. Heretofore not so many have followed directions in a sensible way and not so very many have shown the capacity to practise the self-direction essential to success. Too many expect us to find the way out of the trouble for them, particularly those who have tried "cures." Surgery has proven its ability to help; it would seem well to increase its opportunity.

With respect to the pathology of this very serious malady, we will consider first, what makes the difference between the forms which are tolerable and the forms which are dangerous to life. The first essential in the difference is the metastatic diffusion of germs. In the forms which are tolerable the forces of defense and repair are apparently sufficient to prevent excessive bacillary metastases; in the forms which are dangerous, the spread of the bacilli and their products into new tissue is apparently too rapid.

The second essential is contamination of the lesions of tuberculosis by other organisms, especially the streptococcus. Often a tuberculous process burns itself out and the individual enjoys relief. But too often such a tolerable situation is spoiled by infection with secondary organisms. In consequence the equilibrium of such patients becomes precarious, to say the least. The final stages of pulmonary tuberculosis owe their clinical features largely to catarrhopyogenic infections. Were it not for these, many people might live with tuberculosis for years in a state of health, comparatively safe and comparatively satisfactory.

The third essential is an unclosed hole in the lung. Within cavities, whatever their size, lie blood vessels whose walls have been weakened by the inflammatory changes which have existed about them. Such blood vessels no longer supported, may rupture with disastrous consequences; supported, such a sequence of events would be forestalled.

If these three observations concerning pathology are true, then there is no escaping the conviction that the victims of advanced pulmonary tuberculosis are in great danger. If any of them are to be saved for themselves as well as for service, they should be given the benefits of surgery while there is yet time.

We would now like to call attention to one more aspect from a pathological point of view, which seems to be worthy of consideration, namely, the crippling effects of natural healing. We will quote the words of Prof. Sayago, who evidently very well senses this situation. "On cicatrizing, the tuberculous lesions, particularly those of the cavernous type, bring about a reduction in the volume of the diseased lung which, then, causes other anatomical alterations that favor the cicatricial process . . . Sclerosis of the tuberculous foci compromises the normal static condition of the thoracic wall, of the vertebral column, of the mediastinum and of the diaphragm, all of which may

suffer displacement and retraction of variable intensity . . . The most important of these mechanical alterations is the deviation of the trachea and heart which at times, reaches considerable proportions. It is in such conditions that surgical procedures lend their aid, completing the work that the organism has imposed but has not been able to terminate, owing to the impossibility of conquering the rigidity of the thorax."

There are a number of other observations concerning the physiology and pathology of the lungs which might be mentioned and which are relevant. But if only these which we have set forth are borne in mind, one may appreciate how surgery may influence favorably tuberculous lesions in the lungs.

Among the advantages claimed for the methods—pneumothorax and multiple costectomy—employed in the management of certain cases of phthisis, are the following:

First, they may save the patient time, punishment and money. They may accomplish in a few weeks what months of bedrest would never bring about successfully. After one has witnessed the relatively rapid improvement in a febrile, toxic patient following directly the introduction of a few hundred c.c. of air into the pleural cavity or following a well-executed multiple costectomy, one cannot but realize that the patient is being saved months of invalidism, suffering and expense.

Second, they may induce relaxation of pulmonary tissue. Apparently essential to the localization and healing of a focus of infection in the lung is the establishment of an ample degree of defunctionalized tissue about it. This is nature's barrier to check the metastatic diffusion of germs and is a part of the process of defense and repair.

Third, they may make possible the apposition of the walls of cavities and the cessation of accumulation. Unless holes in the lung are closed to the invasion of microorganisms, most distressing is the state of these people.

Fourth, they may exercise control over the situation in the lungs irrespective of the cooperation of the patient. With one or both lungs artificially deflated up to the limit of tolerance, a patient may not pursue activity without disturbing his respiratory comfort.

Fifth, they may create about the lung most affected conditions conducive to its welfare regardless of the behavior of the individual. Thus protected, a patient may become industrially efficient with more safety.

Sixth, they may anticipate the crippling effects of natural healing, especially the embarrassment of the heart due to its displacement and fixation in an abnormal position.

Undoubtedly a larger number of susceptible people would be more successful in their struggle with pulmonary tuberculosis if their management might be undertaken and might be intelligently carried on before irreparable damage had ensued through neglect. It is altogether too evident that the danger people with tuberculosis of the lungs are in is not being sensed opportunely and that a *laissez faire* attitude is being entertained too long toward many cases making little or no progress with respect to recovery. Too many cases are striking examples of conservative therapy applied without success, with as little foresight as though pneumothorax and thorocoplasty were not available. Standing in the way of success in the surgical management of the terminal stage of pulmonary tuberculosis is the appearance of the cases too late, due partly to the disposition of people to let well enough alone and partly to the apparent reluctance upon the part of the profession to resort to other than medical measures until the patient is mortally ill.

Brown says, "The neglect of cavities and the continuance of sanatorium treatment for cases that never had the slightest chance of closing cavities, unassisted, is bad practice. The wrong in the situation, if there is one, is the neglect of the individual until surgery is a last resort."

Dubrow says, "The perfection of technique in thoracic surgery and its more general application have materially aided in enlarging the list of restored cases."

If one considers all the circumstances surrounding the victims of phthisis, it is obvious that only a very few, relatively speaking, are being given a chance. Until time and experience have demonstrated the superlative advantages of good surgical management, it is evident that many are going to miss their opportunity to make a recovery.

With reference to the radical methods employed to induce contraction of the lung in the management of advanced pulmonary tuberculosis, we would like to emphasize the following:

First, sanatorium or conservative treatment is to phthisis what morphine is to appendicitis. The patient is only temporarily made comfortable in the majority of cases while his chances of life are ebbing.

Second, just as in appendicitis, so in advanced tuberculosis of the lungs it is dangerous to delay the induction of conditions the most favorable for healing within the thorax.

Third, if the methods of inducing contraction of the lung are feasible methods, it is our duty to apply them early, lest the individual lose ground and become incurable.

For the sake of appreciating the effectiveness of these methods in the relief of this very serious condition, it is also necessary to remember that the normal coefficient of improvement may not be determined in any case. One cannot ever know in a condition like chronic tuberculosis how effective any measure applied for its relief may be, because one cannot establish a true basis for comparison. The only real control is the individual himself and as he cannot be used for treatment and control at the same time, there is no way to determine certainly just how much good the effort exerted in his behalf did him. The effectiveness of any "cure" or of any method of treatment, like pneumothorax or thoracoplasty, may only be established approximately, as it may seem to effect more recoveries than would ordinarily be expected.

Absolute rest of the parts affected secured by exercising control over the physiological activity of the adjacent lung tissues, in the presence of a spreading tuberculous process, is good practice. It is recommended for the transformation of such a process into a healing one. Surgical procedures to reduce the functional activity of a lung affected by disease should be undertaken early, lest irreparable damage ensue through neglect. It is most advisable to anticipate the sinister influences of fibrous pleurisy or adhesions, the non-specific infections of the tubular structures, and the continuous escape of tubercle bacilli and their products into the general circulation.

Discussion

E. W. Hayes, m.d., Monrovia, Calif.: Surgery, meaning the more general use of pneumothorax and thoracoplasty, is a relatively recent adjunct in the handling of pulmonary tuberculosis. Just what its position should be in this work I feel has not yet been clearly determined. However, the results of this form of treatment have established the fact that it is a valuable asset in properly selected cases. As in any form of new therapy, I think it is well that we should adopt a conservative attitude lest the pendulum swing too far in its favor.

Years of experience have demonstrated that tuberculosis in all its stages may be effectively cured by the rest, nutritional, and climatic regimen, and that a large number of these patients so cured are returned to health without apparent crippling defects.

In the essayists' discussion we are given the impression that resort to surgery should be made even in the early cases. With this I do not agree because in the first place, under proper supervision and care, the great majority of these cases will recover without surgical intervention. In the second place, surgical intervention is not void of undesirable results. Pneumothorax, the simpler of the surgical means, to be effective, must be carried out for

more or less of an indefinite period. Again, it has its complications such as superimposed spontaneous pneumothorax and hydrothorax which may become pyothorax. In the case of a pyo- or a long standing hydrothorax, or even a long induced pneumothorax the pleura becomes so thickened that when the induction of air is discontinued the collapsed lung does not expand, but with the mediastinum it shifts to eliminate the air space, and the result is a marked hypertrophy of the other lung and a marked deviation of the mediastinal contents.

Thoracoplasty is a much more serious procedure than pneumothorax. There is a distinct surgical shock involved which tuberculous patients in general do not well withstand. It also necessitates a contralateral lung with very little, if any, active disease. Again, it brings about such a marked deformity in the chest wall that we are hardly justified in subjecting our patients to this procedure before they have been given a reasonable opportunity to demonstrate whether or not they can recover their health without it.

I agree with the authors that we should not be too conservative regarding these procedures, and that many times patients who are taking the cure are allowed to drift along perhaps for several years until their finances are gone and their spirit of determination broken, while with others the possibility for help and restoration to health has passed. The timely intervention of surgery in many of these cases would greatly shorten the period required for this first class to regain their health, while in the case of the second class it would in many cases be a life saving measure. However, I believe we should sound a word of caution lest it become the general impression among tuberculous patients that surgery opens up a short cut for them to health and that it is not necessary for them to chase the cure. The result would be a spirit of restlessness which would be a serious handicap to a large number of patients whose tuberculosis could be cured in a relatively short time by a conscientious cooperation in carrying out the treatment without subjecting themselves to the hazards of surgery.

The authors in their opening paragraph have stated that "the indications in the treatment of tuberculosis are to place the patient in surroundings most favorable to the maintenance of a maximum degree of nutrition, to take such measures as in a local or general way, might influence the tuberculous process and to alleviate symptoms." To these I would add, and perhaps as the most important, to place the patient, as far as possible, in an environment which will enable him to reconcile himself to the disease and to the cure, and thus bring about a proper mental and emotional relaxation. Under these circumstances the physician would be in constant mental contact with his patient and at the same time would be able to keep himself in constant touch with the disease process. In this way patients would not only be given a proper opportunity to regain their health without surgical intervention, but the physician would be enabled by his knowledge of the individual patient as a whole and by his acquaintance with the type and character of the disease process in the lungs to determine when surgical intervention should be instituted.

We must always endeavor to place ourselves in the position of the patient and in the light of our knowledge to make our decisions accordingly.

CHARLES C. BROWNING, M.D., Los Angeles: Surgery of the chest has made rapid strides during the past few years, and great benefit has accrued to many patients.

When marked advances have been made through the introduction of new methods there is a tendency for the existence of ultra-conservatism on the one hand and over-enthusiasm on the other.

The position taken by Doctors Hoit and Mattison regarding the operation of thoracoplasty on early cases appears to me to be somewhat advanced and extreme at this time; it may appear to be conservative within a few years. Naturally, there is a tendency to consider all improvement due to treatment administered, overlooking the many cases who recover without special form of treatment.

I believe that much good will come to an increasingly large number of patients from skillful, conservative chest surgery performed upon carefully selected cases.

CARL R. HOWSON, M.D., Los Angeles: Pneumothorax has been a wonderful addition to our therapeutic armamentarium, and there is no doubt that it has meant life and health to many thousands of otherwise doomed patients. Thoracoplasty is a procedure of much more recent development, and one from which we hope for great things. Pneumothorax is a procedure having a very slight operative risk.

It can be discontinued at any time. The majority of the patients undergoing it eventually have healed lungs which function with approximate normality when permitted to expand. Thoracoplasty is a major surgical operation, and once done cannot be undone. The changes brought about are permanent. If done for a patient who has been receiving pneumothorax, it renders unnecessary the prolonged repetition of air injections.

Much of what has been said regarding the uncertainty of the future of patients treated medically and their failure to cooperate fully is only too true, but viewing the situation as a whole I cannot feel quite so pessimistic as the authors about the outcome under medical treatment. The great majority of early and moderately advanced cases are cured by such means. It is unfortunately true that many of them suffer relapses. Pneumothorax and thoracoplasty greatly lessen this risk in most cases but they do not do away with it.

Even the induction of pneumothorax is not devoid of risk, apart from that of the operation itself, for as yet we cannot always determine whether the better lung will not manifest new or increased activity following compression of its fellow. This risk is much greater with thoracoplasty.

The formation of fibrous tissue is the essential process in the healing of tuberculosis, and, as has been pointed out, in the far advanced cases this is not always devoid of undesirable effects, such as distortion of the trachea and displacement of the mediastinum and heart, but these are not necessarily of serious import. It is surprising how much such displacement can occur without giving rise to symptoms or discomfort. We frequently see patients whose hearts are greatly displaced, even entirely to the right of the midline, who complain only of some shortness of breath on exertion, perhaps not more than the curtailment of pulmonary tissue would account for. The displacement occurs very slowly and the heart possesses great power of adaptability under such circumstances. These patients are usually quite unconscious of any abnormality. The same is true of pleural adhesions.

An open cavity is no doubt somewhat of a menace to the individual and yet we see many persons who have been restored to full earning capacity who carry open cavities in one or both lungs for indefinite periods. Were thoracoplasty devoid of risk, we should probably advise most of such persons to be operated upon. However, until the operative mortality drops far below its present figure, we must think well before subjecting our patients to the procedure. In the last analysis it is a matter for the clinical judgment of the physician and of the surgeon working together. The physician has studied his patient, usually over a long period of time, and knows something of his reactions, something more than can be learned in the brief period the surgeon is likely to have him under observation, and it is only by close cooperation between them that the patient's interests will be served. In properly selected cases we may hope for life-saving results, and as the technic is improved and the operative risk correspondingly decreased, the indications for the operation will probably increase.

DRS. MATTISON AND HOIT: We are well aware of the success of the medical treatment of cases of pulmonary tuberculosis and we appreciate the liberality evident in the discussion, in conceding that surgery may offer certain cases of phthisis a better chance of recovery than medicine. We regret that we have not been successful in the management of cases in the last stages of consumption; we have yet to see a case "doomed to a life of invalidism or premature death" cured by medicine. We have seen several cases of phthisis restored by means of surgery to an unprecedented state of health and in a relatively short period of time. It is easy for us, therefore, to see very great possibilities for good in this form of therapy and to see even greater possibilities for good, if only it might be utilized as a preventive, to stop "an advancing lesion in the lung, especially in people who cannot afford medical treatment and who must continue to work in spite of their pulmonary tuberculosis." We believe that there are very many cases of phthisis who are losing ground for the lack of surgical assistance and we are confident, as the result of our experience, that many of these might, through surgery applied in time, be returned to the world not exhausted and industrially useless but vigorous and capable of earning a living.

We rejoice to witness surgery increasingly employed in the field of pulmonary tuberculosis. It has seemed to us so hard for these people when they have been refused indicated operations because of their pulmonary condition. Forced to get along without such aid, forced to carry a load of infection in tissues

outside of as well as within the lungs, they have not been given a fair chance to make a recovery, in our opinion. In our minds there is no doubt about the ability of the majority of patients suffering from the various forms of chronic pulmonary tuberculosis to go through even serious operations with comparative safety with respect to life and with respect to the process in the lungs. We believe that the sooner all the tissues of the body including the lungs, are made clean, with respect to pyogenic organisms, the better for the patient. We are convinced that lung tissues are endowed with powers of defense against infection, just as are other tissues, if not more so, and that they are quite as amenable to the application of surgical principles of treatment. It is incumbent upon us to study the physiology of the lungs, to learn about pneumodynamics, to sense not pathology so much as the "state of defense of the organism attacked" to the end that we may render surgical aid in pulmonary tuberculosis at the most opportune time. To prolong bed-rest disregarding the welfare of the whole body for the sake of a part is not good physiological sense; to shorten the period of convalescence by any "short cut" which can be developed is good medicine; to save patients suffering time and expense in their struggle with pulmonary tuberculosis is worthy of our unceasing efforts and transcends all other considerations.

For years medical men have placed barriers against surgeons arounds the field of pulmonary tuberculosis. Until recently they have regarded this field as their special domain, forbidding surgeons to enter at their peril. They have hardly ceased raising the alarm of "fire" (reactivation of a tuberculous process) whenever operations of any kind have been suggested. Fortunately a few surgeons have dared to break through and the results of their work prove that surgery has an equal if not a dominant place in this field of medicine. The roentgenogram, the sputum test, the nuclear shift and the blood sedimentation tests are not less fallible than years of experience and are quite as full of meaning to the intelligent surgeon as to the veteran specialist.

There is no good reason, in our opinion, why every case of pulmonary tuberculosis, found in an advanced stage or tending that way, should not have the benefit of a good surgeon's experience and skill. There is no justification, in the light of accumulating experience, for postponing surgical intervention in cases of phthisis until the patient is at the point of death. Soon surgeons will take their rightful place in the field of pulmonary tuberculosis and insist that advanced cases be submitted to them for their examination and operation if in their judgment it is indicated, just as now they ask and fully expect performance in cases of appendicitis.

THE TREATMENT OF FACIAL SCARS

WITH REMARKS ON THEIR PSYCHOLOGICAL ASPECTS

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NEW YORK

THERE are certain psychopathic phenomena which are encountered in the practice of plastic surgery which have received little or no attention, or at least seem not to have been commented upon in the literature. The citation of one or two illustrative cases will perhaps serve better to bring out the important points than would an abstract psychological discussion of the subject.

A surgeon from Chicago brought to me a man upon whom he had operated for a scar which had crossed the Langer lines on the cheek. At the time the operation was performed, some five years previously, the patient was tuberculous. Although the surgeon who performed the operation had done excellent work, he had lost sight of the fact that scars in tuberculous persons, especially when they cross the Langer lines of tension, are likely to show thickening, and this scar had proved to be no exception to the rule. An obsession relative to the scar, which had evidently developed long before the operation was performed, increased thereafter. The doctor was at his wits' end to know what to do. Despite my desire to be of assistance to him in his predicament, I refused to operate because of the man's psychological condition, feeling that no matter how fine and unobtrusive might be the line which would remain after operation, the obsession would not be removed. This same man came into my office two months ago. The scar, which I would have recognized had it been noticeable, had almost disappeared. When he recalled the scar and the circumstances of the former consultation, I told him he was to be congratulated upon the disappearance of practically all traces of the operation. His reply was: "You can still see the scar in certain lights and something must be done about it. Scars on other parts of my body do not show like this one." He then exhibited two scars, one on each wrist, which were due to attempts at suicide on account of the almost invisible scar on his face.

Obsessions of this sort are common in scar cases. I have brought up this case because, in addition to the obsession, it affords an opportunity to call attention to three points: (1) The lines of Langer and their effect on scars; (2) the effect of the tuberculous diathesis on scar formation; and (3) the irregular formation of scar tissue in individuals of a keloid tendency.

Several reasons deterred me from attempting to operate upon this patient. First, I was well aware that the work of the surgeon who had operated upon this patient was of the finest character. Therefore, the thickened scar was not in any way due to the fault of the operator, and furthermore it would probably reform following a secondary operation. It is an accepted principle of facial plastic surgery that in any operation on a scar that crosses Langer's lines of tension the result will not be as satisfactory as though the original scar followed the direction of these lines. Secondly, the patient, in the case under discussion, was of the tuberculous type, in fact, had spent three years in a tuberculosis sanatorium. Practically all tuberculous patients develop scars that thicken into welts before they disappear,

and these welts remain for many months. Thirdly, this patient gave evidence, to a certain extent, of a keloid tendency. Here it may be well to point out that a person may have a keloid tendency affecting one part of the body and yet show no such tendency in other parts of the body. That my judgment was correct in deciding not to operate in this case was shown by the fact that later the man attempted to commit suicide on account of his facial defect, which I could not have remedied.

FIG. 1. Author's oblique cutting scapel.

This is only one of many similar cases which I might cite.

Earlier in my career in reconstructive and plastic surgery, I had no hesitation in operating to improve any type of scar that might be presented for treatment, but experience has taught me that many factors should be considered before attempting operative intervention in facial defects.

There comes to my mind the case of a young woman who consulted me for the correction of a z-shaped scar on the neck. On examination it could be seen that the defect could be remedied by three small minor operations, two longitudinal incisions running parallel to one another, each including part of the oblique line of the letter z, followed later by one operation consisting of a longitudinal incision which would include the two parallel scars, thus converting the z into a linear hairline. The original z-shaped cut had been received when the patient was a child. In this case the operation was started without taking into consideration that, in the first place, the patient had an obsession relative to the manner in which the original scar detracted from her appearance. In the second place, I failed to take into account the fact that the patient had a tuberculous diathesis, and that corrective wounds would form welts which would persist for a considerable period of time and would retain their

redness longer than in the average case. The result was that after the second operation the young woman did not wish to submit to a further surgical procedure because the redness was so slow in disappearing. By the time the red coloration had disappeared the resultant scars, though only hairline in each instance, had become the subject of such a marked obsession with her that she threatened suicide. She was referred to Dr. Habermann, who stated that she was a psychopath, and that the obsession had probably been present long before corrective measures had been instituted. He was of this opinion because on close examination he could see only the fine hairlines that remained after the attempt to remove the original disfiguring z-shaped scar.

This brings me to another point, namely, the prognosis regarding the results of scar removal in patients of the type under consideration. When an individual has a tendency to become obsessed with his defects, the surgeon, knowing his ability to minimize the defect, is tempted to advise the patient of the results of his experience as applied to his particular case. He is likely to state that the outcome of operative intervention will be to reduce the scar of considerable size to one of the type known as "hairline." When he yields to this temptation, he is treading on dangerous ground, for the reason that even with everything favorable to a perfectly satisfactory end-result, there are many conditions that may arise to interfere with the usual favorable course of events before the ultimate end-result is attained. The individual is often impatient and expects to see a pleasing result immediately. Under these circumstances an obsession may develop during the preliminary stage of a reconstructive procedure requiring two or more separate operations, and when the corrective operation is completed the patient may still be dissatisfied.

In order to illustrate to what extent, short of suicide, an obsession will sometimes affect an individual, I may cite

the case of a beautiful young woman who recently came to my office heavily veiled, wearing two veils, in fact. When she raised these two veils she exposed a small pock mark, which ordinarily would not have been observed by ninety-nine out of one hundred persons. She informed me that she never went out with her face exposed in the day time, and often sat beside the river debating as to whether life was worth living when she had such a disfiguration as this pock mark. The danger of operating upon such patients is self-evident because regardless of the degree to which the scar is minimized, the obsession will still persist. On the other hand when a scar constitutes an actual deformity and such actual deformity can be markedly improved by operative intervention, the plastic surgeon is enabled to effect a change in that patient's mentality which probably could not have been achieved by any other means.

PROGNOSIS

These cases are sufficient to impress upon the reader the necessity of considering scars from the standpoint of obsession; and before proceeding to discuss the various types of scars from the etiological and clinical standpoint, it may be well to discuss a little further the matter of prognosis. Under no circumstances should the surgeon commit himself on the subject of scar prognosis. He cannot be too guarded in this respect. He should always advise those who come to be operated upon for a scar, that while he is usually able to minimize the scar to a point bordering upon invisibility, a great deal depends upon the healing power of the individual and upon his personal idiosyncrasy. Indeed, these factors are just as important as the surgeon's skill.

ETIOLOGY OF SCARS

It is essential that scars be considered from the etiological standpoint for it is only in this way that one is enabled to decide what operative procedure is applicable in each individual case.

There are many agencies which may produce scars, but by far the vast majority of scars are caused by accident or operation. These are called *traumatic* scars.

The term *electrical* is applied to those scars which are produced by radium, roentgen rays and short-circuit injuries. A scar which results from the overaction of radium or roentgen rays is usually flat and mottled, with a white shiny base and scattered pigmentation. Scars of this type usually extend deeply into the tissues, often causing the skin to become adherent to the underlying structures. While they give no visible evidence of being congestive, they are, nevertheless, the most difficult of all scars to treat satisfactorily. They bleed excessively, and the condition of the tissues is such that grafts or transplants do not "take" kindly and readily slough out. If such a scar is small in extent and an attempt is made simply to excise the scar tissue and draw the apparently healthy skin together, it will be found that the surrounding area, while having the appearance of health, has a decided tendency to heal poorly or to slough out, leaving a wound as large, or nearly as large, as the original scar (Fig. 2).

Short-circuit scars are those which result from electric explosion due to short-circuiting. They are usually burns and are associated with a certain amount of copper infiltration of the resulting wound. The microscopical flakes of copper injected into the tissues produce one of the most painful of wounds. Fortunately, however, unless the burn is extensive little or no scarring results and as a rule time will do more to eliminate this type of scar than will the surgeon's knife.

Caustic scars may be produced by excessive action of any of the corrosive acids or alkalies. In these cases the surrounding tissue is usually healthy, so that in their treatment only actual scar tissue without additional surrounding skin need be removed.

Phosphorus scars, that is, scars resulting from phosphorus burns, on the other hand, are similar to short-circuit burns in that if given sufficient time they will usually disappear almost completely of themselves.

Under the heading of skin diseases we find three types of scars which are in each instance difficult to handle. These are the *pock-marks* left by smallpox, chicken-pox and acne rosacea. These scars if not too deep are best treated by the derma-
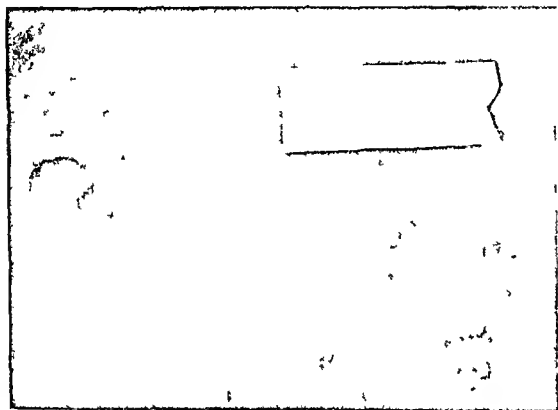
Fig. 2. Example of the mottled appearance of a radium scar.

tologist who advocates their elimination by applying to the area involved caustic acids, usually mixed with oil. These methods are known to the layman as "skinning" or "face peeling."

Scars which are the *results of malignancy*, for example, those of healed rodent ulcer or those remaining after the resection of an epithelioma, usually hold out to the surgeon a danger signal. The attempt to remove a defect of this kind often ushers in the return of the original malignant condition. A case comes to my mind in which an epithelioma of the lower lip had been resected. The patient was later referred to a plastic surgeon for reconstruction of the lip. The scar before excision was old and white and there were no signs of any malignancy until after incisions had been made for the removal of scar tissue. Within a few weeks the incisions for the plastic work were beds of epithelioma cells.

A few months ago I was consulted by a patient who had been successfully treated for rodent ulcer. The left orbit and left side of the nose had been involved by the disease. Nothing remained at the points of attack but scar tissue. I refused to operate or to undertake any reconstructive surgery. The patient then consulted another surgeon who attempted to transplant tissue and reconstruct new parts. Within a period of a few weeks all the incisions were in a condition similar to those in the case quoted above. Malignancy had attacked the operative field and the patient was considerably worse off than before the attempt had been made to improve his condition.

In the subjects of constitutional disease, three types of scars must be considered: the *tuberculous,* the *syphilitic* and the *idiopathic* scars. Just why thickened scars should form in a person who has a tuberculous heredity or active tuberculosis is not known. It is my belief that this phenomenon has something to do with faulty aeration of the blood, for the reason that similar scars may form in patients suffering from temporary bronchial affections. For example, one patient upon whom I had performed a series of operations for paraffinomata had formed unusually fine cicatrices. After one operation, however, she had a severe attack of bronchitis which confined her to bed for several weeks. This one scar resulting from this one operation, out of the many that had been performed immediately before the attack of bronchitis, resulted in a typical tubercular-like, thickened scar. Later when the patient had fully recovered her health this scar was removed, and then the usual fine cicatrices formed.

Scars of the scalp heal kindly as a rule but are subject to two minor postoperative defects: first, sebaceous cysts may form along the line of incision or laceration; second ingrowing hairs may develop along the same line. Hence for some time following operation the patient should be kept

under observation in order that any sign of the development of these conditions may be detected.

Syphilis may cause a scar to become depressed, due to absorption of areolar tissue underneath the wound. In these cases it is, therefore, always advisable to recommend antisyphilitic treatment in conjunction with any operative procedure which must be undertaken.

Certain scars may be said to be *idiopathic*.

There are varieties of ticks in the tropics, which burrow underneath the skin, produce congestion and cause an urticaria of the overlying skin. The area of congestion becomes converted into shiny fibrous tissue having all the appearance of a cicatrix. Scars somewhat similar in appearance are often found following pregnancy and also following loss of weight in previously excessively obese individuals. These scars are usually superficial in appearance, slightly depressed, free and white.

TREATMENT

In the treatment of scars, in addition to taking into consideration the etiology, the character of the scar itself plays a part in deciding upon the most appropriate procedure to be followed.

Superficial scars may be entirely removed and their place filled in with a graft or transplant, or they may be removed in a sectional manner, the surrounding healthy skin being undercut and stretched over to bridge the section removed. This method is the one I prefer when it is applicable.

Deep scars, if not adherent to vital underlying structures, may be similarly treated, the deeper tissues removed at the time of operation, being replaced by transplants of fat.

Scars may be *free* or *adherent* to underlying structures; they may be *white* and atrophied, or *red* and congested. It is not good policy to operate upon a scar while it is red and congested, since the result

may be a recurring scar just as annoying as the original.

Contracting scars result from heat burns and scalds. If the burn is severe they may produce deformities of the surrounding tissues. Before operating upon this type of scar, it is advisable to inject the scar tissue with thiosinamine over a period of several months. This softens the scar tissue and permits the operator to obtain a better estimate of the amount of skin
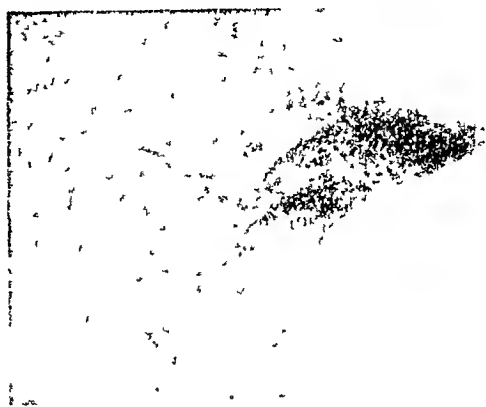
Fig. 3. Example of a contracting scar.

grafting necessary to meet the requirements of the defect.

Angular scars (Figs. 4 and 5) are always best handled in two operative procedures for if the surgeon attempts to eliminate them in one operation the area at the angle of the wound may undergo necrosis. These scars almost invariably require resection of the fat from beneath the angle of the original wound. Otherwise they develop an overhanging condition, the tissue above bulging over the tissue below the wound angle.

Depressed scars are usually also adherent, so that before operating it should be explained to the patient that it is usually necessary to remove a section of fat from another part of the body for use as a transplant to replace the deep scar tissue which must be removed.

In the treatment of the opposite type of scar, namely the *elevated* scar, many methods are employed. In the earlier part of this paper the cause of elevated scars was considered, so it is unnecessary here

to state that the condition of the patient must be taken into consideration. Has he a keloid tendency? Has he a tuberculous tendency? Is he suffering from a temporary bronchial affection? In some of these cases the triple treatment brought to the atten-

FIG. 4. Overhung scar, showing fatty tissue in the angular flap.

tion of the profession by Grattan produces very gratifying results. In other cases it will be found that excision alone is all that is necessary. But in every instance the cause should be sought and, if found, should be combated by the usual methods of constitutional treatment.

FIG. 5a. Angular scar showing collection of fatty tissue in the lower angle.

Motheaten scars, that is, those resulting from infection in dense tissue such as the end of the nose, have received this designation because of their appearance. This type of scar (Fig. 8) is greatly depressed at its center, and it has sharp, definite edges.

Scars of this description require considerable preliminary treatment before surgical correction is attempted. The base of the scar should be stimulated to form new granulations by scarification with either the knife or trichloracetic acid. At the same

FIG. 5b. Same scar after primary operation.

time the edges also may be treated with trichloracetic acid to remove their sharpness. The application of this acid alone will often produce the desired results

FIG. 5c. After the final operation.

and will save the surgeon the necessity of undercutting the surrounding skin and endeavoring to approximate the edges.

INDIOSYNCRASIES OF SCARS

Like individuals, scars have their own idiosyncrasies. When they occur in the

FIG. 6. Angular scar, showing collection of fatty tissue in the angle of the scar.

region of the ears or involve the ear tissue or the upper part of the chest, they have

FIG. 7. Example of keloid-like scar formation about the ears, less pronounced above the brow.

a marked tendency to become keloidal in appearance. Scars about the orbit, especially if parallel to the lines of Langer, become practically invisible, and in a much

shorter time than those situated in other localities. Following operative procedures for the removal of paraffinoma, regardless

FIG 8. Example of a motheaten scar.

of the part of the body in which they occur, the scars are slow in healing and until all paraffin is removed produce thickened welts. The tendency to keloid-

FIG. 9. Parffianoma scar, referred to the author This type of scar is not unusual in these cases following preliminary operations to remove paraffin. This case was not due to faulty technique on the part of the operating surgeon.

like scar formation about the ears as compared with other regions of the face and body is illustrated by Figure 7. Here it will be seen that the scar above the brow is very slight, while as it approaches the ear tissue it becomes more pronounced in its keloid-like appearance. Furthermore, the scar above the brow follows Langer's lines of tension and is markedly small as compared to the portion external to the orbital angle. Keloid-like thick-

ening is likely to occur as the result of any accidental injury in this region.

OPERATIVE TREATMENT

In the removal of any scar, when it has once been decided that it can be effaced or rather that it can be minimized to what we are pleased to call a hairline, the method of procedure depends upon whether one plans to introduce a transplant or a graft, or simply to draw the surrounding skin together after the scar has been removed. In any case in the excision of the scar it is always advisable to make all incisions in healthy skin that is entirely outside of the scar tissue. If grafting is to be employed, undercutting of the surrounding tissues is undesirable, as it may invite bleeding, with the formation of a blood clot beneath the graft or transplant. If on the other hand it has been decided that a transplant or graft is unnecessary, and one plans merely to excise scar tissue, the more undercutting that is done the easier it will be to correct the defect. Whatever incision is made around the scar should be made with an oblique-cutting scalpel (Fig. 1). If sutures are found to be necessary, whether between graft or transplant and the surrounding skin, or between the healthy skin edges of the wound which have been drawn together over the area formerly occupied by the defect, they should be subcuticular in character. The suture material which has given me the most satisfactory results is horsehair.

At the completion of the operation powdered turtle bile should be dusted along the wound edges and, if a wound is on the face, no dressing should be applied; the patient should be instructed to expose the wound after the first twenty-four hours to air and sunlight. During the first twenty-four hours an ice-bag should be kept constantly over the operative field. This measure prevents infection and congestion with its consequent hemorrhage underneath the graft or between the wound edges. It also diminishes the pain that might otherwise be present. The patient is seen daily and at each sitting the wound is saturated with a 2 per cent solution of thiocyanate in physiological saline solution. This preparation is made from the saliva of a healthy dog.

This mode of treatment has yielded remarkably satisfactory results in my hands. If the patient has a tendency to keloid thickening, either from tuberculous diathesis, keloid diathesis or any other unknown reason, this usually begins to manifest itself in from two to three weeks after the operation. The patient should then be referred to the electrotherapeutist who can successfully reduce the thickening, in one or two treatments by using the static brush discharge.

CONCLUSIONS

Not all scars should be subjected to surgical treatment. An obsession relative to a scar, syphilis, a tuberculous or a keloid diathesis, a temporary bronchial affection or other constitutional disease may make it unwise to undertake a surgical procedure.

The result in corrective surgery about the face and neck is more or less dependent upon the location of the scar. More pleasing results are always secured, other things being equal, when incisions follow Langer's lines of tension.

The treatment of scars must take into consideration both the type of scar and its etiology.

The procedure adopted for the elimination of a scar may require grafting, the transplantation of tissue, or simply excision of the scar, with undercutting and approximation of the wound edges. The latter is the preferable procedure under suitable conditions.

The after-treatment of a wound is fully as important as the surgical procedure itself. It includes dusting the wound with turtle bile, the application of cold, exposure to air and sunlight, and the daily application of a 2 per cent solution of thiocyanate in physiological saline solution.

Careful attention to the details described make it possible to minimize or practically efface the vast majority of disfiguring scars.

FRACTURED FEMUR

THE PATIENT'S POINT OF VIEW

James S. Hall, M.D.

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FIVE weeks ago I fractured my femur and in due time found myself in St. Luke's Hospital, flat on my back burdened with weights, rope, Thomas splint, etc. The alignment is fine, there is no shortening and the roentgen-ray check-up shows everything going strong.

I have treated many fractures of the femur, and have roentgenographed many time relieved the nurses and orderlies of all heavy work.

A suspension frame of the type designed by Dr. H. H. M. Lyle (often miscalled a Balkan frame) and used generally in the Allied armies, was erected about the bed. On top of this frame I had the hospital carpenter lay two pieces of "two by four" running parallel from head to foot. These
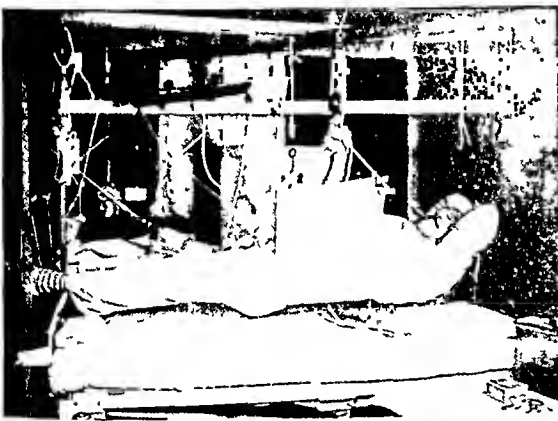
FIG. 1. Illustrating apparatus by means of which patient may lift himself or easily be lifted several inches above the level of mattress. The advantages are obvious.
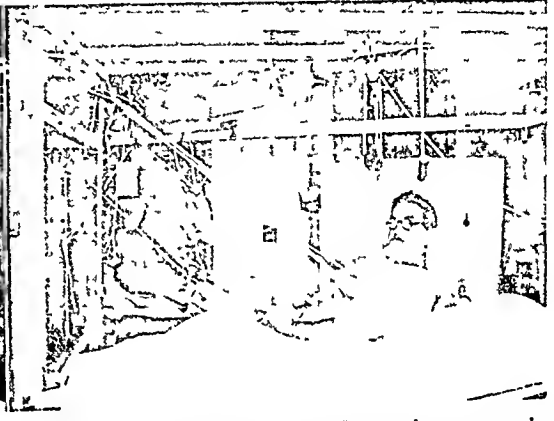
FIG. 2. Showing device whereby patient can raise himself or be brought to sitting posture. The ability to remain comfortably in this position greatly facilitates massage and care of the back.

more for my associates. My mind was always concentrated, as it should have been, in getting good results, sometimes forgetting, I fear, to provide the greatest possible comfort for the patient. But now, from the patient's standpoint, I am thinking more of the physical well-being and condition to be had during all the weary weeks. These factors are usually left to the nurses and orderlies. Not that the surgeon is unsympathetic but he simply has little time to spend in consideration of detail pertaining to the personal care of the patient.

Being a physician as well as a patient, I have devised several things that have mitigated my suffering and at the same

pieces are about two feet apart. A sliding cross-piece holds two double pulleys which hook in a canvas sling. With this sling I easily raise myself on a bedpan or place myself on a hair pillow, so that the gluteal region may be massaged and rested. I sometimes maintain this position for an hour, until all pressure pain is eliminated. A set of pulley blocks above and at the foot of the bed with a belt around my back under my shoulders allows me to pull myself up into a semi-sitting position. This greatly facilitates massage and care of the back. All changes of position are effected by myself with no lifting on the part of nurse or other attendant.

For the first few days my favorite indoor

sport was being dragged down toward the foot of the bed by traction weights, and then with the help of two suspended handles and my good leg, getting back to the head of the bed for a fresh start. To prevent sliding I first had a wooden rest made to fit between my good hip and the foot of the bed. I later found three ten-pound sand bags backed by an air cushion more satisfactory, both from the point of comfort and to prevent sliding. These hold me in any position I care to assume with reference to the foot of the bed. A ten-pound weight tied to the ring of the Thomas splint and supported by a pulley attached to the superstructure prevents the ring from dropping backward when I am elevated in the canvas sling.

At night I sleep on a small air mattress, two by five feet. This affords a change from the ordinary hospital mattress and is most valuable in obtaining sleep. Other small things which would take too long to describe have been added from time to time.

The devices mentioned have meant everything to me in this long grind. Except for the first few days there has been no painful, uneven lifting by orderlies with tilting of the pelvis, no dropping back of the Thomas ring, no bad night with backache, and no chance of bed sores.

I feel that many elderly patients might be saved and that the younger ones might be made comparatively happy by these simple devices.

RUPTURE OF THE CRUCIAL LIGAMENTS IN THE KNEE JOINT

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THIS uncommon injury is produced by complete dislocation of the tibia on the femur, forward, backward or laterally. Sometimes a forcible backward hyperextension snapping of the knee causes it.

Symptoms. This injury causes immediate marked effusion into the knee joint. Objective evidence of a dislocation is marked. In diagnosing crucial rupture, the knee is flexed at an angle of from 45° to 90°, with the foot resting on the floor or table. The examiner then grasps the shaft of the tibia with both hands, and manipulates the tibia backward and forward on the femur. If the crucial ligaments are ruptured, preternatural play exists, both backward and forward (Fig. 1). The roentgen ray is a valuable supplement to the symptoms in the making of a diagnosis.

Treatment. Conservative treatment consists in early application of a plaster cast from the foot to the thigh, with the knee in a position of 20 degrees' flexion. This position is the best for rapid healing. The cast should be allowed to remain on for at least two months. Passive and active motion and massage are then begun. After removal of the cast for the following two months the patient should not be permitted to walk or indulge in weight-bearing without the aid of a knee cage (Fig. 3). The knee cage controls the lateral stability of the knee and at the same time limits flexion. It should be worn for at least six to eight weeks. At the end of this time, if there is no play at the joint, the crucial ligaments can be considered as healed. The physician can then help the patient to regain strength and stability by instructing him in the re-education of the quadriceps muscles.

Voluntary contraction of the quadriceps from the relaxed stage should be practiced as many times a day as possible with the limb in the position of extension. If this is done the stability of the knee very quickly returns. Voluntary contraction is practiced with the patient standing upright, the affected limb held straight. In a month and a half to two months after this re-
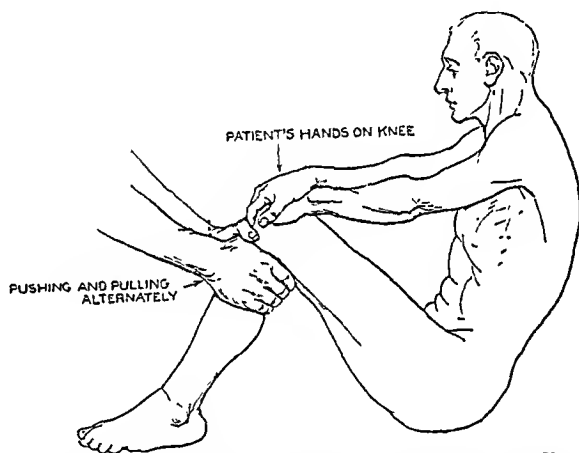
FIG. 1. Determining acute rupture of the crucial ligaments.

education is begun, the patient can return to work.

It is claimed by some orthopedic men that the patient, through proper muscular education, can develop a compensatory function which obviates the use of the crucial ligaments altogether. In a patient employed in heavy manual labor I greatly doubt whether this is possible; first, because of the muscular atrophy that follows this injury, and second, because heavy weight-bearing demands the use of the strong crucial ligaments.

Prognosis. The period of disability without operation extends over approximately four months The prognosis must

323

be guarded, however, since a chronic ruptured condition may establish itself, in spite of all non-operative attempts at healing (see the following section).

CHRONIC RUPTURE OF THE CRUCIAL LIGAMENTS IN THE KNEE JOINT

This much-discussed condition commonly follows a dislocation of the knee, due to the fact that under the treatment described in the preceding section the crucial ligaments fail to heal.

Treatment. In one chronic case I repaired the anterior crucial ligament by means of an operation based on an anatomical study and tryout. In view of the fact that following the operation this man has been working steadily for two years with an almost perfectly functioning limb as a coal passer the technique of this operation may be of help to other surgeons.

Preoperative Preparation. To begin with, prior to operation the physician should satisfy himself that the patient is a good surgical risk, because the operation consumes at least one and one-half and usually two hours. The patient, then, must be strong enough to withstand the strain of a long period under anesthesia.

The limb should be scrubbed from the thigh down to the toes, on the night before operation. It is then shaved and washed with soap and water, followed by plain water. Ether or alcohol is then used, and a mild bichloride dressing applied from the perineum down to the toes. This is left on all night. In the morning a quarter of a grain of morphine and $\frac{1}{150}$ grains of atrophine should be administered half an hour before the anesthetic is given.

Operative Technique. This operation, in which the Lane technique is followed rigidly, is conducted entirely under the control of a tourniquet, so that it is practically bloodless. The limb should be painted with iodine followed by alcohol from the point of the tourniquet, which is applied at the upper and middle third of the thigh, down to the ankle. The limb must remain exposed from the line of the tourniquet to four or five inches below the patellar tendon. The primary stage is done with the limb extended on the table; the remainder of the operation is carried out with the knee flexed over the end of the table. (Fig. 2, A and B.)

A lengthwise incision is made on the outer side of the thigh, extending from the junction of the middle and upper thirds, down to the knee. It is then carried around and below the patella, to its inner side. This incision permits of subcutaneous dissection. The entire flap is turned back, thus allowing complete exposure of the fascia and the patella. The knee cap is sawed perpendicularly through to the inner surface. Upon reaching the inner surface a broad chisel is inserted and the inner surface of the patella fractured. An incision is made from the point of fracture upward through the quadriceps, a distance of three inches. Another one is made lengthwise from the lower margin of the fracture, extending downward in the patellar tendon toward insertion. The patella is drawn apart with retractors and the ligamentum mucosum severed. Occasionally one will find the ligamentum mucosum already ruptured and atrophied, in which event no further attention is necessary.

At this point the limb is dropped over the end of the table and flexed to a right angle. With the knee flexed the two fragments of the fractured patella naturally draw still farther apart. (In the first case on which I operated, I discovered at this point that the posterior crucial ligament had healed, but the two ends of the anterior crucial ligament were lying free in the knee joint.) A subperiosteal resection is done on the inner side of the tibia and also a subperiosteal resection under the cruraeus of the femur at the external condyle. By means of a Murphy drill a hole is made up through the inner head of the tibia, coming out through the long axis of the remains of the anterior crucial ligament. After retraction of the cruraeus, a hole is drilled

on the outer side of the condyle of the femur, down to the long axis of the ligament. An incision is then made on the

and passed through the upper opening down through the axis of the ligament, coming out at the lower opening of the
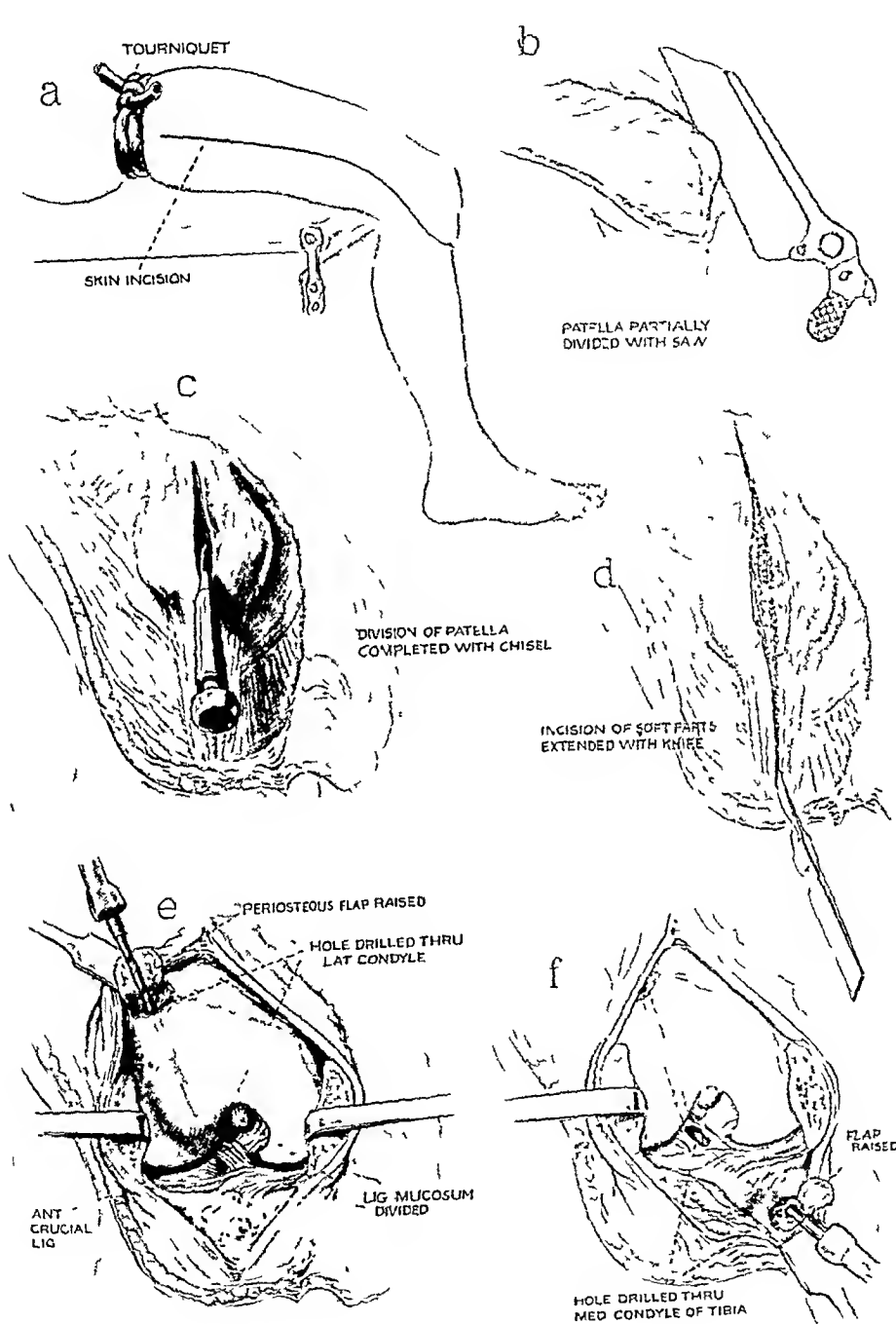
FIG. 2A.

outer side of the thigh and a strip of fascia, about 10 inches in length and 1½ inches in width, is removed. A silk ligature with a carrier is attached to one end of this strip,

tibia. The limb is then flexed at an angle of 20 degrees, a position which takes up the normal tension of the ligament leaving approximately one inch exposed at either

end. The parts of the ligament left exposed are laid flat on the bone and can be either sutured to the periosteum or covered with a

using approximately 1 ounce of the powder to 2 ounces of the liquid. The cruraeus muscle is now sutured over the exposed

a

FASCIAL STRIP REMOVED

b

ROLLED STRIP CARRIED THRU

c

ENDS OF STRIP SUTURED THRU PERIOSTEOUS FLAP

d

LIG MUCOSUM SUTURED

e

APON SPLIT BACK FROM PATELLA

HOLES DRILLED FOR WIRING

f

FREE ENDS OF TWISTED WIRES BURIED IN SHALLOW HOLES

g

CLOSURE OF FASCIA AND APONEUROSIS

h

SKIN CLOSURE

i

KNEE FLEXED 20°
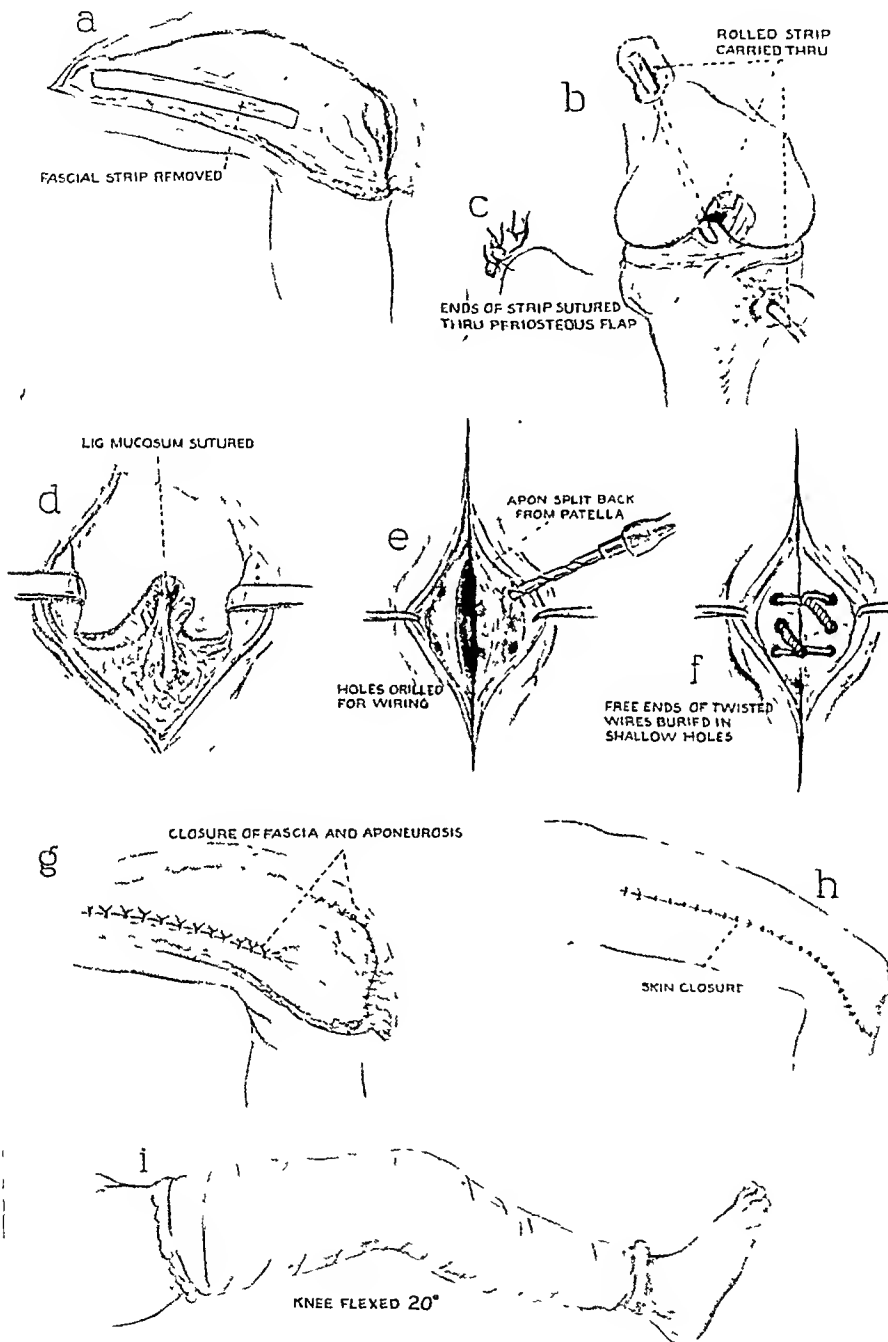
FIG. 2B.

trap door of bone. The entire joint is now saturated with a combination of sterilized powdered iodoform combined with ether,

ends of the false ligament. The periosteum of the condyle and the periosteum of the tibia are next sutured with No. 0 pyoktanin

catgut. A No. 00 pyoktanin catgut is used to repair the ligamentum mucosum when necessary, and the patella is wired with two transverse wires. Since working out this operation and performing it on two other cases I have found it is not necessary to use wire in the patella, as a line of kangaroo in the aponeurosis is sufficient. The quadriceps and patellar aponeurosis are sutured with medium kangaroo tendon. The line of incision on the side of the limb is closed with No. 2 interrupted pyoktanin catgut, and the skin layer closed with interrupted silkworm sutures.

After the tissues are closed a plaster cast is applied from the thigh to the toes, with the limb still maintained in a position of 20 degrees' flexion. I wish particularly to emphasize that this is 20 degrees. The cast should remain on for at least six to eight weeks followed by the wearing of a knee cage (Fig. 3) for two to three months together with quadriceps education.

In my first case, the patient returned to work three and one-half months after operation, and suffered no loss in his earning capacity. At the present time there is only very slight play in the knee joint. The patient cannot flex his knee completely; he can flex it to an angle of something more than 90 degrees, and can extend it fully.

The first case operated on was in 1922, since which time two other operations have been equally successful.

I do not offer this operation as a certain cure for every case of chronic rupture of the posterior and anterior crucial ligaments. All I can say is that it has brought about satisfactory results in the case of my patients. In view of the fact, however, that my first case has been kept under observation for three years, and now has a knee joint that functions very satisfactorily, I feel justified in describing the technique of the operation in order that other surgeons may at least give it a trial.

Prognosis. Unless an operation such as is described above is employed for the relief of this condition, the patient suffers serious permanent functional disability. I
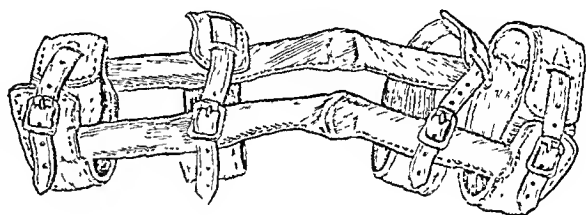
Fig. 3. Knee cage.

seriously doubt whether, especially in patients whose work calls for much weight-bearing, the education of muscles that may compensate for the crucial ligaments can be successful. The operation described may on further trial be found to offer hope of a good functional result after four months of postoperative treatment.

As to the posterior crucial when not healed, I am unable at this time to offer any operative solution. However, even where both anterior and posterior are ruptured and fail to heal, I feel sure that the building of an anterior crucial alone would be of significant assistance to the patient.

THE RESULTS OF
PUNCH PROSTATECTOMY*

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SYMPTOMS of urinary obstruction presumably due to prostatic hypertropy are frequently out of proportion to the amount of prostatic enlargement palpable on rectal examination. In such cases a cystoscopic examination may show that the symptoms are due to hypertrophy confined entirely to the median lobe of the prostate or to the subcervical group of glands described by Lowsley. More frequently they are caused by bar formation at the neck of the bladder, the result of inflammatory changes in the mucosa and underlying prostatic tissue. Guthrie first called attention to these changes in the neck of the bladder a century ago in a lecture before the Royal College of London. He pointed out that because the symptoms are analogous to those resulting from prostatic hypertrophy, many attempt to treat the obstructing bar as a hyperplastic process instead of as prostatic atrophy with inflammatory changes, which Randall has so clearly demonstrated it to be. He mentioned the frequency with which small sclerotic prostates are removed and said "that to drag from its bed the atrophic adherent and sclerotic tissue which frequently forms part of the condition of median bar formation is an operation taxing not only the energies but the utmost skill and anatomical knowledge of the operator; while the dangers from injury to antiguous structures by hemorrhage and the actual failure to sometimes remove anything should contraindicate such a procedure."

TECHNIQUE

To perform complete prostatectomy in order to remove such a comparatively small amount of obstruction has seemed illogical to many urologists, including Young, who has said, "the amount of tissue removed at suprapubic operation is so small that it seems ridiculous to have to perform a major operation for its removal." In 1909, following an unsuccessful attempt to cure a patient with median-bar obstruction by suprapubic prostatectomy, Young devised the median bar excisor by modifying his urethroscope. An opening was made in the wall of the urethroscope to engage the bar formation and a circular knife of a diameter slightly smaller than that of the instrument constructed, which punched out the obstructing tissue. Although Young reported 156 cases treated before 1917 using this instrument, and in his recent book reviews a series of 355 cases, the operation has never met with the popularity that it deserves. There are two possible reasons for this, the fear of uncontrollable postoperative hemorrhage and the necessity for performing the operation without adequate vision. It is true that the small portion of tissue to be removed can be seen by reflected light through the shaft of the instrument as it projects through the opening, but its position and relationship to other structures are not discernible because the instrument has a closed end and no direct illumination. Without a visible field, unless the operator is expert, it is evident that the base of the bladder, trigone or triangular ligament might easily be cut instead of the median bar.

In 1918, Braasch, in an endeavor to overcome this objection, modified his direct cystoscope so that the operation could be carried on under vision. The

modification consisted, as in the Young instrument, of a window in the lower wall of the direct cystoscope close to the distal end. As the lamp was retained and the distal end left open, the operator was able to see the tissue to be removed not only as it entered the window, but also prior to its engagement and in relation to all other adjacent structures. The dilatation of the urethra and bladder with water makes the removal of multiple portions of the obstruction easy, as the bleeding field is kept free from clots, a complication that greatly handicaps an operator using the other type of instrument. To overcome the frequent objection of complicating hemorrhage, Caulk, in 1920, modified the Young punch so that a cautery blade was substituted for the circular knife and to this modification and its author must be given the credit for the recent popularization of the operation, which he believes is suitable in 40 per cent of all cases of prostatic obstruction.

REVIEW OF CASES

As these two authors are the only ones who have reported any considerable series of cases treated by this method, it seemed that a review of the results obtained at at the Mayo Clinic in a series of 192 cases in which the different types of instrument were used would be of interest. One hundred fifty-three of these operations have been performed since January, 1924, during which period 895 prostatectomies were performed, either perineal or suprapubic, a ratio of 1:6. It has frequently come to our attention that many members of the profession are quite sceptical of the permanency of the results obtained from a punch operation. This review should be of interest in determining whether it is merely a palliative measure, giving relief for a short period until subsequent prostatectomy becomes necessary, or is a satisfactory form of treatment for a selected type of case.

During 1914, 1915 and 1916, ten operations were performed with Young's instrument. As the procedure was new, it is probable that the group was not well selected, for at that time the limitations of the operation were not appreciated as well as now. As a result, it was necessary to perform prostatectomy subsequently in two cases, in one a few weeks after the punch operation, and in the other a year later. In each case the tissue removed showed only chronic inflammatory changes without adenomatous hypertrophy. It has been necessary to perform prostatectomy in seven other cases (4 per cent) of the remaining 182 in the series. In four of these the operation was performed within a month of the unsuccessful attempt. One was performed four months later, the other six months later. In the last case the patient was advised that subsequent prostatectomy would be necessary because of hypertrophy of the lateral lobe, but he did not return for the operation until a year later. These unfavorable results bring up the point as to whether glandular enlargement or true inflammatory fibrous conditions are most likely to react disappointingly to treatment. Keyes writes: "It is the fibrous rather than the adenomatous obstructions that will—shall we say immediately recur or immediately not be relieved? It comes to much the same thing because the scar has not been wholly divided." Taking the opposite view, Frontz states: "Personally I do not feel that it is an operation which should be done for prostatic adenoma." In this group of nine cases in which a second operation was performed the pathologic reports showed inflammatory changes predominating in seven; in only two was the enlargement due to adenomatous hypertrophy. More important, in our opinion, than the type of enlargement is the presence or absence of intraurethral enlargement of the lateral lobes. If they are enlarged the removal of a portion of the median lobe will simply tend to exaggerate the lateral hypertrophy by permitting the lobes to fall together and overlap. In seven of these nine unsuccessful cases such enlargement was noted and undoubtedly explains the failure.

If the enlargement is adenomatous and confined entirely to the median lobe we

believe that a better prognosis is warranted than if it is due to chronic prostatitis. Such limitation of hypertrophy is rare; furthermore, in only twenty-one of the 160 cases in which the tissue was examined microscopically was adenomatous hypertrophy noted, and then it was usually associated with chronic prostatitis. In 126 cases the prostatic tissue was inflammatory, showing most emphatically what type of enlargement is best suited to this form of treatment. With one exception subsequent prostatectomy was not necessary in any case more than six months after the operation, a fact that emphasizes the statement of Caulk that "if a man remains well for six months he usually will remain well forever."

From 1916 to 1922 the instrument designed by Braasch was employed in twenty-eight cases. In three of these cases it was used to remove remnants of prostatic tissue that obstructed the posterior urethra following previous prostatectomy. In each case the tissue removed showed adenofibromatous hypertrophy on microscopic examination. This complication following prostatectomy is seen only too frequently and usually, as in these cases, occurs following a two-stage operation during which the gland has been removed without adequate exposure through a dilated suprapubic sinus. The persistent sinus after the second operation is a distressing complication to both patient and surgeon, for there is considerable risk in subjecting such a patient, usually advanced in years, to further surgical procedures before he has fully recovered from the previous operations. The punch operation offers a happy solution to the difficulty, for the prostatic bed can be satisfactorily seen, and the obstructing portions of the gland remaining easily removed; usually the suprapubic sinus will close without further treatment. This procedure was followed in this series of cases six times, in four successfully with permanent closure of the sinus. In ten other cases it was performed for the relief of symptoms of obstruction following previous prostatectomy without persisting sinus.

The removal of the obstructing portion of a prostate with recurring malignant disease offers still another field of usefulness for the punch operation. If the obstructing portion of the growth is removed the patient is saved from constant use of a catheter often quite as distressing and aggravating as the slowly growing neoplasm. In fact the procedure should not be confined to the recurrent malignant lesions, but may be used as a valuable palliative and preliminary measure in many cases of carcinoma of the prostate. It was so used four times in this series and could undoubtedly have been applied advantageously much oftener. How gratifying the results may be when it is used as an initial procedure in cases of carcinoma of the prostate was illustrated in the case of a patient who died recently. In February 1925 he came to the Mayo Clinic complaining of frequency and dysuria. At rectal examination it seemed that the malignant process had extended to the seminal vesicles, but at cystoscopic examination it appeared to be confined to the median lobe of the prostate. A punch operation was performed and from the time of his dismissal from the hospital two weeks later until death, there were no urinary symptoms. At necropsy the bladder showed none of the deformity usually associated with urinary obstruction and, although the portion of the gland removed showed carcinomatous change, the neck of the bladder was completely healed and covered with normal mucous membrane. There was much extravesical metastasis, several of the ribs and one or two vertebrae being completely replaced by neoplastic tissue. Although the patient suffered much pain from these metastatic processes, he was saved the discomfort of constant urinary obstruction, and his family were spared the necessity of providing adequate catheterization during a period of nearly two years.

In 1924, because of excessive bleeding in several cases treated with the knife punch, in two of which transfusion was required, we commenced using Caulk's cautery punch, and employed it in the next eighty-

one consecutive cases, with but four exceptions. In these four cases previous operations or deformity of the neck of the bladder necessitated accurate vision which cannot be obtained with the cautery instrument.

The cautery, when properly used, does prevent immediate postoperative bleeding, which is a strong argument in favor of the cautery punch. The portions of gland obtained are sufficiently large to account for all obstructing tissue if several bites are taken. It does, unfortunately, have several objectionable features, the least of which is the occasional late bleeding occurring one or two weeks after the operation, when the slough comes away. This, in our experience, was usually more alarming to the patient than serious. When we began its use we noticed a high incidence of complications resulting from secondary infection. It would seem that the burned neck of the bladder required longer to heal than one that was incised and, until healing had occurred, was more likely to acts as a focus for ascending urinary infection. The frequency of acute pyelitis following the cautery operation seemed to bear this out, as there were twenty-six cases in which febrile reactions lasted four days or longer; in all but seven fever began on the day of operation. As this represents almost a third of the cases in which operation was performed with the cautery punch, it seemed to us that secondary infection was a serious complication and we discontinued the use of the instrument. Since then we have performed sixty-nine operations with Braasch's instrument and in only ten has there been a febrile reaction lasting for four days or longer, one-half as many as occurred when the cautery instrument was used. The most serious disadvantage of Caulk's instrument, that determined us to change to another type, was the obscurity of the field of operation. In reference to this Young states that in practice he has found the observation of the tissue projecting through the fenestra entirely unnecessary, as with experience one may be certain as to the portion of

the prostate which has been caught within the tube. Caulk, on the other hand, is equally emphatic concerning the necessity of preliminary inspection of the tissue to be excised if trauma to other portions of the bladder or urethra is to be avoided. He writes: "With my punch technic it is perfectly easy to have a thorough vision of the bladder neck and I personally have no trouble in discriminating between bladder and orifice. One can under perfect vision rotate the instrument in different segments of the bladder neck and remove whatever obstruction presents. I can tell not only the bladder neck, but the type of orifice, whether glandular or sclerotic."

Feeling that vision which is confined simply to the tissue which projects into the window of the instrument was of negligible value, we followed the teaching of Young and depended on "feel" to determine the position of the instrument. In this we were in error, for in one case the urethra and in another the wall of the bladder was penetrated. Young reports a similar accident in his series of 355 cases, although it did not occur at his hands. We have since learned that our clinics are not unique in experiencing these unfortunate accidents.

When the cautery punch was abandoned, we formed the habit of examining the patient with the cystoscope immediately after completing the operation with the knife punch. This makes it possible to detect the bleeding points and, by applying a small electrode through the catheter guide, to stop the bleeding by electrocoagulation (Fig. 1). Tolson has perfected an isulated shaft for use with the Young punch for the same purpose, with a contact point that just fits the window. This electrocoagulates the entire excised area rather than just the bleeding points, and for this reason has the objections inherent to a cautery of producing an excess of charred tissue. Since adopting the electrocoagulation method of controlling hemorrhage, we have had difficulty but three times. In one of these cases hemorrhage was controlled by further electro-

coagulation; in the other two cases the bladder was too full of clots to permit of cystoscopic examination and cystostomy was necessary, not alone to control the bleeding, but also to remove the clots. The other cases have been absolutely free from all signs of bleeding except for slight discoloration of the urine for the first day or two. No method of hemostasis is employed, such as an indwelling catheter or bag. In fact, we have come to believe that the presence of any foreign body in
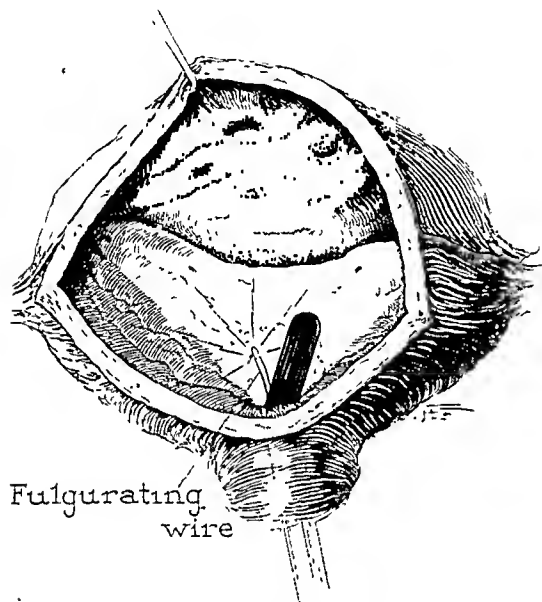
FIG. 1. Producing hemostasis by electrocoagulation.

the urethra tends to stimulate sphincteric action and leads to hemorrhage. The patient is kept on the operating table until the irrigating fluid is clear, which occurs as soon as the last bleeding vessel is touched by the electrode.

Caulk has recently reported his final results in 323 cases in which prostatic symptoms have been relieved in 80 per cent. Young had equally good results in his series of 355 cases.

SUMMARY

In the present series of 192 cases definite information is available in eighty-five of the 157 in which operation was performed prior to January 1, 1927. Twenty-

seven patients (32 per cent) have had no urinary complaint since the operation. In thirty-nine cases (46 per cent) there is improvement in the symptoms of obstruction, although there is a degree of frequency which is definitely less than before operation; therefore, in a total of sixty-six cases (78 per cent) there was improvement; in nineteen (22 per cent) no improvement. A review of the data in these cases previous to operation may throw some light on the cause of failure. In nine of the nineteen unimproved subsequent prostatectomy was performed and lateral lobe enlargement discovered; in seven others there was hypertrophy of the lateral lobes in addition to the median obstruction. In all but two of the nineteen unsuccessful cases the pathologic diagnosis of the tissue removed was "inflammatory." This would indicate that in groups of cases of atrophic inflammatory prostatic obstruction, considered best suited for the punch operation, the poorest results were obtained; however, one must not overlook the fact that such cases not only offer technical difficulty but are notorious for the disappointing results following total prostatectomy.

In all of the cases in which treatment was a failure (except three), symptoms have persisted following operation or recurred within six months. In the three exceptional cases there was no recurrence of trouble until from ten to twelve months later. This would again emphasize the belief of Caulk that a patient's condition a few months after operation is a fair indication of the final results of the operation.

We have heard from twenty-six patients operated on last year. The Braasch knife instrument was used in all of these cases and the bleeding points subsequently electrocoagulated. Fourteen of these patients are entirely relieved, ten are definitely improved, and two are no better. We believe these figures are fairly indicative of the percentage of relief obtained by using the punch operation in any properly selected series of cases.

SPINDLE CELL SARCOMA OF SOFT PARTS OF CALF

AMPUTATION; PATIENT WELL FIVE AND ONE-HALF YEARS LATER*

BRADLEY L. COLEY, M.D.

NEW YORK

R A. age eleven. Male, schoolboy. The patient was admitted to the Memorial Hospital, September 22, 1921, referred by the New York Orthopedic Hospital. At that institution he was first seen in March, 1921, at which time he complained of pain in his left knee. There was a firm mass on the inner side with limitation of motion in the joint. Roentgenogram at that time showed a partially calcified mass on the inner side of the joint. An operation was performed by Dr. Hibbs in April, 1921, and a somewhat gelatinous mass was removed. The joint was fused. Two similar masses appeared in the same region. Tissue from the original tumor was reported to be spindle cell sarcoma.

P. H. When the child was eighteen months of age he fell and hurt his left knee. Shortly thereafter a small lump appeared at the site of the injury. This gradually increased in size and was excised. Pus was said to have drained from · the wound. The lump recurred and increased in size, causing pain which radiated to the bone. This condition existed until three years prior to admission, when the growth was excised. A recurrence was noted six months later which was followed by another removal. Several recurrences took place, the last being the operation at the New York Orthopedic Hospital.

P. E. On admission, examination showed a boy of eleven who was unable to walk because of pain in the left knee. His heart was moderately enlarged and over-active. His lungs and abdomen were negative. In the inner aspect of the left knee there were three soft, fluctuating swellings, each about 2 × 2½ c.m. in diameter, exquisitely tender. The slightest motion of the left knee was painful. There were two or three rather soft lymph nodes in the left femoral triangle. The pro-

visional diagnosis was spindle cell sarcoma of the soft parts of the left knee.

Films made on admission to Memorial Hospital revealed evidence of complete ankylosis; there was no bone destruction and the roentgen features of a bone tumor were absent. Films of the chest did not reveal evidence of metastases.

The boy was treated with three radium packs during the week following his admission. These were given over the inner, outer and posterior aspects of the knee. Because of a definite increase in the size of the tumor amputation was advised four months later.

Operation. Amputation midthigh was done on February 2, 1922, under gas and oxygen anaesthesia.

Pathological report very cellular small spindle cell sarcoma, probably neurogenic by Dr. Ewing.

Postoperative Course. Following the operation, the patient's progress was good and he was discharged from the hospital on the nineteenth postoperative day.

A roentgenogram of the stump six months after showed a small sequestrum which apparently was absorbed, as it never had to be removed and the wound remained healed. Patient was seen in the Followup Clinic 23 times in the following four years. After amputation he received two 15 minute exposures of low voltage roentgen ray to the stump and several injections of mixed toxins. No other treatment was given and he is now shown well 5½ years following the amputation.

This case brings up the following points of interest:

(1) A history of recurring tumors which had been repeatedly excised, the last operation being an extensive resection of the

knee joint; yet the multiple operations did not result in a widespread dissemination of the growth despite the fact that the tissue was reported to be a very cellular small spindle cell sarcoma.

(2) The result is satisfactory following amputation five and a half years ago, a fact which should tend to offer some encouragement to surgeons who have similar cases to deal with.

TRAUMATIC RUPTURE OF SPLEEN
SPLENECTOMY; AUTOTRANSFUSION*

Bradley L. Coley, m.d.

NEW YORK

C M. Male. Age, thirty-six. Iron worker. P. I. Patient was admitted to Bellevue Hospital, Second Surgical Division, August 30, 1926. Patient states that 1½ hours previous to admission he had fallen a distance of 6 feet, striking squarely on his left side across a wooden brace. He was able to get up and walk, but felt excruciating pain over the region he struck.

F. H. Entirely irrelevant.

P. H. Entirely irrelevant.

P. E. Physical examination showed a well developed adult male, appearing to be in shock. He was restless, his face ashen, mucous membranes very pale, giving the impression of severe hemorrhage. Pupils reacted sluggishly. Mouth very dry. A few abrasions present over the left chest in the mid axillary line. Heart showed a left systolic murmur. Knee jerks sluggish. Abdomen held rigid with marked tenderness in left upper quadrant and in left loin. Shifting dullness was present. Kehr's sign was not obtained.

Preoperative Course. Patient was observed and found to be in shock. Because patient refused his consent, operation was delayed for 3½ hours from the time of admission and five hours from the time of injury. His temperature was 99; pulse 74; respiration 20. His urine was examined and was found to contain some albumin and numerous red blood cells and an occasional white blood cell. His blood count was 32,800 white blood cells, polys 91 per cent, lymphocytes 9 per cent. His blood pressure was 70/58. Two hours after admission this had fallen to 65/47. His condition grew worse. He became increasingly pale and weak. Two

and a half hours after admission the entire abdomen was flat to percussion except a small area in the right lower quadrant.

Operative Procedure. Patient was operated on five hours after injury with a preoperative diagnosis of traumatic rupture of spleen. On opening the peritoneal cavity, it was found to be full of unclotted blood. Exploration of the spleen immediately revealed that it was ruptured and that this was the source of the hemorrhage. As far as could be ascertained, no other organs were injured. Palpation of the left kidney showed no laceration. Stomach was normal.

Under gas, oxygen and ether anaesthesia an upper left rectus incision was made. The blood which gushed through the peritoneal cavity was caught in a basin and the spleen was delivered. Its pedicle was clamped between clamps and doubly ligated. Was then tied with plain cat gut ligatures. During this procedure the unclotted blood in the peritoneal cavity was collected in a sterile basin, strained through gauze and when 750 c.c. were obtained, transfused into the right cubital vein by an assistant. This transfusion went along simultaneously with the closure of the abdominal wall and was followed by an additional 300 c.c. of normal saline solution. The abdominal wall was closed in layers, using No. 2 chromic cat gut throughout, with the addition of silkworm gut retention sutures.

Postoperative Course. Patient's condition at the completion of the operation was fairly good. The skin had lost its ashen hue and his pulse was of better quality.

He was transfused that evening, receiving

500 c.c. from a compatible donor. The postoperative course was unusually smooth. His urine showed a port wine color for one day after operation, then became normal. One week after splenectomy his red blood cells were 2,400,000, his hemoglobin 77 per cent. His wound healed by primary union and he was allowed up on the fourteenth postoperative day and went home on the fifteenth.

Pathological Report by Drs. McGrath and Miles.

Gross. Specimen consists of an averaged sized spleen ruptured in its longitudinal and transverse diameter. The capsule is torn and there is hemorrhage into the spleen. Microexamination. Throughout the splenic pulp are seen small hemorrhagic areas; otherwise the organ appears normal. Diagnosis. Hemorrhage into spleen.

This case is shown because of the fact that it recovered after an interval of five hours from the time of accident to time of operation, during which time a very profound intraabdominal hemorrhage had occured. In my opinion the patient withstood the operation better because of the immediate autotransfusion and, while it can not be definitely stated that he would have succumbed without this procedure, it is my belief that it probably saved this man's life.

In a recent report by Dr. Hamilton Bailey of 32 cases of ruptured spleen collected from the London Hospital records in the past thirty years, it is of interest to note the fact that the mortality rate has steadily decreased. Between 1894 and 1914 there were 11 cases with 3 recoveries, whereas between 1914 and 1925 there were 12 cases with 11 recoveries, and the case which died was complicated by a ruptured right kidney.

Dr. Bailey groups cases of ruptured spleen into four classifications: (1) The patient rapidly succumbs, never rallying from the initial shock. (2) Initial shock—recovery from shock. Signs of ruptured spleen. (3) The signs of an intraabdominal catastrophe are delayed. (4) Spontaneous recovery.

The case presented tonight belongs in group 2 of Dr. Bailey's classifications, as did three-fourths of the cases he studied.

STRANGULATED FEMORAL HERNIA

ENTEROSTOMY; LATER ENTEROANOSTOMOSIS WITH MURPHY BUTTON*

Bradley L. Coley, m.d.

NEW YORK

J K. age, forty-eight. Male. Garage worker. The patient was admitted to Second Surgical Division, Bellevue Hospital, November 5, 1926, with chief complaint of violent and persistent vomiting associated with cramp-like pains in the abdomen, and obstipation. Patient stated that three days prior to admission he commenced to have abdominal pain, although admitting some vague abdominal distress for two weeks prior to this, which he attributed to having pushed a large automobile. Just prior to his admission these cramp-like pains became so severe that he was tied up in a "knot" and was vomiting foul-smelling brownish material.

F. H. Entirely irrelevant.

P. H. Entirely irrelevant.

P. E. Examination showed a well nourished male adult in severe pain, appearing acutely ill. His temperature on admission was 99; pulse 120; respiration 20. His general physical examination revealed nothing abnormal with the exception of a few mucous crackles which were heard over the larger bronchi.

Surgical Condition. The abdomen was moderately distended, somewhat tender and

*Read before Section of Surgery, New York Academy of Medicine, Nov. 4, 1927.

tympanitic. There was generalized muscular rigidity, but not board-like in character. In the right groin, apparently along Poupart's ligament, there was globular mass indistinctly outlined beneath the thick layer of fat. There was some induration about this mass and a faint pink blush of the skin overlying it. It was not reducible, gave no impulse on coughing and was exquisitely tender to palpation. During the examination the patient vomited offensive-smelling brownish material in large amounts.

Blood Count. Leucocytes 25, 350; polys 94 per cent; transitional 2; lymphocytes 4.

Urine Report. Negative except for two plus albumin.

Operation. Patient was immediately operated upon under 1 per cent novocaine. A right femoral hernial sac was exposed which, when opened, revealed a Richter's hernia in which about three-fourths of the circumference of the gut was markedly devitalized. On the contramesenteric aspect a greenish area of gangrene and softening was present. Although no evidence of actual perforation was made out, a distinctly foul odor was apparent when the sac was opened. This hernia represented a type that is often described as an acute partial enterocele.

Operative Procedure. An inguinal incision prolonged downward over the femoral opening was made and the subcutaneous fatty layers overlying the femoral sac were divided and the sac exposed and opened. An attempt was made to draw down the bowel to inspect the gut above the point of constriction, which was unsuccessful even after Gimbernat's ligament was divided, because of the fact that the gut seemed to be on the point of rupturing. The inguinal approach was then resorted to and with the peritoneal cavity opened bimanual efforts to reduce the gut were successful. The patient's critical condition decided the operator against resection and the gangrenous loop was sutured into the upper opening in the peritoneal cavity preparatory to drainage of the bowel. A rubber dam drain was placed in the lower angle of the incision, leading to the site of the gangrenous femoral sac which was previously excised.

Interval Notes. Less than twenty-four hours following the operation, an opening was made in the loop of gut which had been brought outside the abdomen and catheters inserted in both limbs of the υ. A prompt and copious discharge of foul-smelling intestinal contents followed by relief of distension and other symptoms of obstruction took place. The abdominal wall quickly became excoriated and an area seven or eight inches in diameter extending up to the umbilicus was within a few days raw and exceedingly painful. Attempts to protect the skin with kaolin and glycerine pastes met with little success and the patient grew weaker through loss of nutrition, owing to the high position of the enterostomy. It was, therefore, decided on November 12, 1920, one week after operation to attempt a closure.

Second Operation. The loop of gut with its opening was easily freed by finger dissection from the adherent muscle circumferentially. Traction on the loop withdrew the gangrenous portion for a distance of 3 inches on the proximal side and 4 or 5 inches on the distal side. This was insufficient on the proximal side, however, to make a suture resection feasible; consequently, the involved section was excised (about 2½ inches of gut were sacrificed) and anastomosis by Murphy button was performed. After the button had been closed, a further supporting peritoneal layer of continuous zero plain cat gut was put in to perfect the serosa to serosa approximation. The anastomosis was then pushed within the abdomen and a large Mickulicz rubber dam tampon was placed in the opening through the abdominal cavity and held by very carefully applied dressings, maintained with many tail binders.

Subsequent Course. Following the second operation, the patient showed rapid improvement. There was no distension and the inflammatory condition of the abdominal skin rapidly yielded to zinc oxide ointment dressings. The Mickulicz tampon was repacked daily and as the wound gradually closed its contents of packing were reduced. It was finally removed and the granulations filled the depression and the wound healed.

Three weeks after the second operation, the patient developed carbuncles on the back of his neck which, on December 1, 1926, were treated in the usual manner by crucial incisions with undermining of flaps. He left the hospital December 13, 1926.

Pathological Report of Femoral Sac. The sac consists in oedematous fat and areolar tissue thickly infiltrated with polynuclear cells. Diagnosis: Acute infiltration, fat and areolar tissue. Culture taken at operation sterile after 72 hours.

Follow Up Note. June 29, 1927. At present the patient is in excellent health and has no subjective symptoms, but examination shows there is a small ventral hernia above the incisional scar. It is unquestionably a hernia through the intermuscular incision through which the gut was brought and the Mickulicz tampon subsequently placed. There is no impulse or other sign of hernia through the femoral opening, despite the fact that no femoral repair was done at operation. The patient was advised to have a Gallie living suture operation for ventral hernia, but refused because he is not sufficiently inconvenienced.

This case brings up the following considerations:

(1) The essential importance of local anaesthesia in strangulated hernia operations.

(2) The value of the combined inguinal and femoral approach in these cases.

(3) The use of enterostomy as a lifesaving measure where resection and anastomosis would be likely to result fatally.

(4) The use of the Murphy button for a quick resection, especially where sufficient bowel can not readily be mobilized for suture anastomosis.

(5) The adaptation of the Mickulicz tampon to provide drainage and prevent evisceration.

ᴗ E D I T O R I A L S ᴗ

NECESSITY FOR THE INDUSTRIAL OPHTHALMOLOGIST

DURING the last fifteen years there have been many changes and advances in the field of medicine and surgery, in the latter probably more than in the former. There has been a new order of things surgical, and out of this rearrangement, industrial medicine and surgery have come to the front. This new development is indicated by the establishment of chairs of industrial surgery in several medical colleges, and further by the American College of Surgeons in their traumatic surgery division. All this has been done in recognition of the importance of good medicine and surgery in industrial cases, and probably more to broaden the scale of this somewhat neglected field. Several years ago the younger men were attracted to this branch of practice on account of the quicker and surer, although somewhat smaller, returns, and without the sounder judgment that eye and experience usually give, inferior work and poor results were often met with, probably too often. Then came the gradual reaction;

the better men improved the technique of handling these cases; corporations, insurance companies, and the unions put pressure in the right direction, and as a result, today we have a specialty within a specialty. This field of endeavor has in the last few years been brightened by the addition of several of the better general surgeons to its ranks.

With all this progress in the general surgical division, there has been recognised the need for the ophthalmologist who could and would devote his energies to new problems constantly arising. It would be far fetched to say that the field of ophthalmology was divided into a branch similar to industrial surgery, yet it is not too much to say that the average good ophthalmologist often does not get the right viewpoint on the average industrial eye case.

It has been well said that if a man would succeed in industrial surgery, the care of his cases should be governed by equal respect for the patient, the employer and himself. It has been my experience during

the past ten years in the field of industrial ophthalmology that with a few minor exceptions all that the corporation or insurance company asks is a "square deal;" they are glad to pay for a compensable injury, but will fight non-compensable or fraudulent claims to the limit. How often they pay for the latter types, only those in this field of endeavor realize.

The viewpoint of the industrial surgeon and ophthalmologist is somewhat different than that of his fellow practitioner, and necessarily so, as each case must be looked at from both the scientific and economic side. Not only is it desirable to get the best result, thereby conserving vision, but it is also important to get the patient back to work as quickly as possible. This is of benefit to the man as he is less of an economic loss to himself, and the experience rate paid by his employer to the insurance company is thereby lessened. In the average moderate trauma to the eye, it often takes considerable urging on the part of the surgeon to induce the patient to return to work quickly. This of course depends upon several factors. Plasterers at $20.00 a day cannot get back to their jobs quickly enough, in fact they often require reverse English. Plodding laborers and men with anarchistic views are satisfied with a forced vacation with hopes of prolonging it. I personally know of one case in which a man refused to return to work for five months, fraudulently claiming an eye injury, his family and self being dependent upon county charity during the period of "treatment and trial." Patients with eye injuries are ambulatory cases except a small percentage, and the majority of the former class can work while under treatment, if not at the same kind, then some other lighter work. It is of benefit to them from the economic standpoint and also their morale; indirectly it is of benefit to the employer and insurance company.

Very few men do things without a reason, and therefore in the private practice of ophthalmology patients who malinger are seldom seen. When we enter the field of industrial surgery, the positions are reversed. It has been my experience that 70 to 75 per cent of this type of cases do or have a tendency to malinger in varying degrees, and this is not limited to the more ignorant patients either. The desire to obtain something for nothing, or the self-satisfaction apparently felt by "putting one over" the corporation is quite prevalent. I have seen it attempted by school teachers' and others of like accomplishment. Among the lower classes, this is aided and abetted by unscrupulous lawyers and ambulance chasers, without the fear of prosecution for perjury or being accessory. Elaborate tests are not needed, the simpler ones being sufficient and more easily demonstrable before the industrial arbitrator. It is my routine in all industrial eye examinations to take the real vision with the malingering test first, and then to give the patient a chance to tell the truth with the naked eyes.

It is not at all uncommon to find borderline cases, congenital errors, conditions dependent upon disease, or those due to previous injury, associated with or without recent compensable injuries. In such cases the history is of little value at times, as there is the tendency toward fraud, and therefore we are ever on the alert for the claims of aggravation of a preexisting condition. Congenital errors of refraction, amblyopia ex anopsia, diplopia unrelated to injury are met with quite often. Trachoma with its multiple complications, catarrhal ulcers, and interstitial keratitis are often brought forward as a claim for treatment and later for specific loss of vision. Presenile or senile cataract in both eyes, alleged to be due to injury of one eye, detachment of the retina in high myopia due to trivial injury, spontaneous vitreous hemorrhage secondary to over-lifting are a few of the conditions for which claim is filed and defense is necessary.

There are cases of primary simple glaucoma, specific iritis, and a multiplicity of fundus lesions which result in

varying degrees of blindness, and for which indemnity is asked. Besides these I have had a case of proven self-destruction of one eye for the amount of money awarded in such cases.

It is evident, therefore, that the ophthalmologist in the industrial field spends considerable time in court. Not only when there must he be able to express his findings in the case on trial in a concise, clear manner so that the arbitrator will understand him, but he must also be able to combat properly the cross examination of the opposing counsel. I have seen some of our better medical men made to say about the opposite of what they intended to say, or their testimony changed to such indefinite statements that the case was lost on this account. The ophthalmologist in the industrial field will not be amiss if he understands something of the rules of evidence used in court of law.

Since every eye injury is a potential law suit, the insurance companies now insist that every case be seen by the oculist, thereby fortifying themselves to a greater degree. This routine was not started by the companies for the above reason alone. Five or six years ago it was found by an industrial surgeon of very large experience in Chicago that temporary disability and specific loss could be cut down materially if such cases were seen at once by the ophthalmologist. The last few years have proven his assumption correct, so that fewer eye cases are now treated by the general surgeon in this field. Along with the routine examination, other things were accomplished such as the detection of non-compensable conditions which are found only by the ophthalmologist whose value in such cases is in his court standing and testimony. Conversely, there is occasionally a condition which to a general surgeon appears quite trivial but one that ophthalmologists find to be quite serious.

As in all other lines, as soon as industrial surgery becomes developed, organization is necessary. With the type of cases and the volume of work, naturally a basis of fee comes into use. This has been the cause of much misunderstanding on the part of the ophthalmologist in private practice and the insurance companies. There is merit to both sides of the controversy. I shall not attempt to discuss either, but will say that as an average this type of work has as much if not more remuneration from all angles as that of private practice. In conclusion, I believe that the industrial ophthalmologist is of added service to the patient and of real value to the employer and insurance company. so that now he is a real necessity in this field of traumatic surgery.

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BRITISH LETTER

A VERY instructive debate took place during the last session of the Royal Society of Medicine on the present position of the operative treatment of cleft palate. It must have been very interesting from the point of view of the president, Sir James Berry, who took part in a similar discussion sixteen years ago. Sir James has done pioneer work in England in this particular phase of surgery and has been one of the foremost advocates of the Ferguson or Langenbeck operation.

At the former meeting the main point at issue was the relative value of the turnover flap operation in very early infancy compared with the operation of lateral approximation of the edges of the cleft. The president's introductory remarks are, therefore, of considerable value. He maintains that the chief object in operating upon a cleft palate is to enable the patient to speak intelligently; it is in no sense a life saving operation. A cleft palate does not stop a child from swallowing. The proper way to deal with a newly born infant afflicted with a cleft palate is to feed it properly, preferably with the mother's milk given by means of a teaspoon. It is not a safe or sound policy

to attempt an extensive operation with its attendant loss of blood and sepsis, and it is impossible at this very early stage to perform a lateral approximation operation with a reasonable chance of success owing to the width of the cleft and the lowness of the palatine arch.

It must be remembered that a wide cleft palate at birth becomes gradually narrower as the child grows older. This narrowing is greatly accelerated when the accompanying hare lip is closed within the first few months of life. His practice is to choose sometime between eighteen months and three, or possibly, four years, and he strongly urges the occasional operator on such cases to wait until a much later period, despite the fact that there is a great advantage in closing the defect before the child has learned to speak.

In a really difficult case, such as one involving the soft palate and most of the hard palate, in his opinion it is often a good plan to close the cleft in the soft palate first and to leave the hard palate unclosed for a time rather than to risk failure of the whole line of union by attempting too much. In many such cases, and in some cases of complete cleft, he often leaves the anterior end of the cleft unclosed rather than endanger the vitality of the flaps by severance of the anterior palatine artery. In any operative measure it is most important that the soft palate should be well united, otherwise little benefit will accrue. The aperture in the hard palate can be closed at a later date, or at the worst an obturator can be worn. He refers briefly to some general lines in his treatment which stress the importance of preoperative treatment, particularly the special need to correct gross defects of the teeth and tonsils, and the necessity of making sure that the child is in good general health.

With regard to the position of the patient on the table, he prefers to stand on the right side of the patient facing the head. The patient's shoulders are elevated and the head thrown well back so that the blood runs into the upper part of the pharynx. He uses a type of gag devised by a former colleague, the late Sir Thomas Smith.

Of the actual operation he calls attention to two points, first, the importance of an adequate but careful separation of the soft parts from the bony palate, taking care not to endanger their vitality by hazarding the blood supply or by damaging the muscles of the soft palate unduly, and secondly, the lateral incisions should be as short as possible, seldom more than half an inch in length. He would rather depend upon the use of deep tension stitches for the soft palate than upon very long lateral incisions.

In after treatment the patient is fed on nothing but milk or milk and water for at least a week. No washing or spraying of the mouth is permitted, except that on each occasion after feeding the child is given a drink of warm water. The patient is kept out of doors as much as possible, weather permitting.

On the fourth day the palate is inspected and it is decided when the tension sutures, if in use for the soft palate, should be removed, usually on the fifth or sixth day. He maintains that if the operation has been carefully and properly done with gentleness, avoiding excessive bruising of the tissues and loss of blood, it is seldom that a complete failure occurs.

The discussion was carried on by surgeons having a special interest and experience in this particular type of operative work, and revealed the fact that the majority were practising the lateral approximation operation with certain peculiar differences in technique. There was by no means unanimity of opinion as to the best method of relieving tension on the suture line. Most appeared to be in favour of a long lateral incision in spite of the president's declaration of preference for the short incision and the use of tension sutures.

Mr. O. L. Addison (London) expressed his conviction that success could be

obtained only by the avoidance of tension and sepsis, and to prevent the former long lateral incisions were an absolute necessity.

M. Victor Veau (Paris) described a modified flap operation which he had developed on the basis of Lane's method and which was giving in his hands excellent results.

Mr. C. H. Fagge (London) operating for complete clefts advocated a two stage operation, first stage by a Lane flap operation at about the second to third month, second stage by a Langenbeck operation on the soft palate before the troubles of the first dentition began. He further expressed himself to be in strong disagreement with the use of tension sutures which he said sloughed or acted as unnecessary foreign bodies.

Mr. Grey-Turner (Newcastle) described a very good exposure by using von Eiselsberg's gag, the patient being placed in the head down position. Anesthesia is obtained by ether oxygen administered from a Shipway apparatus through a catheter conducted into the naso-pharynx. He further emphasises a scrupulous regard to minimise haemorrhage, maintaining it is not sufficient to mop up the blood; it must be arrested by steady sponge pressure, and the time necessary for this purpose must never be grudged. He gives a warning that an efficient suction apparatus may be a disadvantage by disguising a really serious loss of blood.

Mr. Kelsey Fry (London), speaking from the point of view of a dental surgeon, and one who has been associated with Mr. H. D. Gillies in the treatment of cleft palate cases, declared that the closure of the hard palate may be the cause of a contracted arch, a loss of contour of the face, and a cause of bad speech, by the pulling forward of the soft palate towards the middle of the palate; all of these could be avoided by the use of a plate to close over the opening. Plenty of tissue to form a freely soft palate would be left; this will restore to the child the all important function of speech.

A written communication was received from Dr. Truman W. Brophy (Chicago) wherein he tabulates some 1706 cases of this special operation done by American colleagues giving results as to mortality and necrosis; unfortunately he makes no definite statement as to phonetic results. This omission renders any practical comparison of results impossible. The Brophy operation is not widely practised in this country, partly because it is said to be accompanied by a greater degree of shock than occurs in the other types of palate operation, and also because the forcing together of the under developed maxillary bones alters materially the subsequent growth and contour of the face bones.

The Bradshaw Lecture at the Royal College of Surgeons on November 10th was delivered by Sir Cuthbert Wallace, K.C.M.G., a vice president of the College of Surgeons and surgeon to St. Thomas's Hospital, under the title "A Review of Prostate Enlargement." In his introductory remarks he said: "Recent years have added little to our knowledge of the function of the prostate. It is not apparent that it has any internal secretion or that it exercises any influence on metabolism; it is a secondary sexual gland."

In his short historical survey he quotes the following paragraph from a lecture delivered by Moynihan in 1908: "The first suprapubic prostatectomy done in England was performed on March 24th, 1887, by McGill. In that operation and in many subsequent ones he removed only a small portion of the prostate in one piece, or in many pieces, cutting away the projecting and obstructing parts of the gland with scissors. Later Mr. Jessop introduced his "ring scissors" which made this piece-meal removal of the gland an easier matter. The first attempt at enucleating a portion of the prostate was made in Leeds on December 15th last by Mr. Edward Atkinson. This was during my House Surgeoncy, and I quite well remember the enthusiasm the genial operator had for the case and the simplicity of the

procedure. On December 17th, 1887, Mr. McGill employed this method of enucleating; a portion of the prostate weighing 20 ozs., 4 grs., which surrounded the urethra laterally and below, was enucleated in one piece."

Moyniham was at this time a resident at the Leeds General Infirmary and so far as the history of the suprapubic operation in this country is concerned, these dates can be considered authentic. These early enucleations initiated by McGill were, however, attended by a high mortality from the fact that the attempts were made on patients whose general condition was extremely bad. The profession in England as a whole did not favour these operations even in thec losing years of the last century and eagerly took up the so-called sexual operations only to find them for the most part ineffective. It was not until Freyer published his series of successful cases in 1900 that the real value of the suprapubic prostatectomy was established.

The lecturer put forward some general views on the causation and nature of the enlargement, and of the ensuing symptoms. The fate of the cavity left by the operation is remarkable, in that it rapidly contracts and not only are the sides brought together but the bladder is at the same time approximated to the urethra. This contraction he asserts is caused by the resilience of the remaining part of the prostate and it may be looked upon as one of nature's means of producing hemostasis; it also reduces the surface to be covered by epithelium. He states further that should the opportunity arise of inspecting and digitally examining the bladder again after a prostatectomy, it is remarkable how little abnormality is to be made out. In his reference to the two stage operation, he says the discovery and perfection of tests of urinary efficiency have extended and rendered more accurate the indications for the performance of this operation. He says later, however, that the surgeon has been more chary in performing the one stage operation, and the deaths that formerly would have been recorded under prostatectomy are now to be found under the head of cystotomy. Nevertheless, a striking fact is the good results that follow the two stage operations in spite of certain disadvantages.

The suprapubic method is undoubtedly the method of choice for most general surgeons. The perineal operation in the hands of Hugh Young is a wonderfully effective operation with an extremely low mortality compared with the hospital figures quoted by Wallace, who gives for a total of 219 cases operated on between 1922 to 1926 a mortality of 20.1 per cent.

This figure appears very high for our present day technique compared with those from some special hospital's. American statistics and the lecture has led to a certain amount of correspondence. Sir T. Carey Evans thinks the lecture and figures quoted afford clear evidence of the necessity for establishing genitourinary departments in all our large general hospitals, and for encouraging specialisation in this important branch of surgery. He has always looked upon suprapubic prostatectomy as a special operation requiring in its performance a particular knack or gift which is only acquired by, or bestowed upon, surgeons who eventually specialise in this particular branch of surgery. He maintains that so long as it is claimed that this operation is part of the general surgeon's work the mortality rate will remain where it is. This latter contention of Sir Thomas's does not, and will not, find favour with the general surgeon; the improvement must come from earlier operation, more care in the selection of cases, gentle surgery, and more detailed care in the preoperative and postoperative phases. Wallace quotes Young's and also Wildbolz's figures for perineal prostatectomy, viz., 3–4 per cent and 6.5 per cent respectively, and says earlier in his paper "that if it could be shown that children had been born to parents who had undergone perineal prostatectomy, it would be a point in favour of that operation, as a

restoration ad integram is always desirable. I am unaware, however, that a man has ever begat a child after prostatectomy." Curiously this statement has been replied to by Sir John Lynn Thomas and C. C. Elliot who give definite instances of paternity of men from whom they have sometime previously removed the prostate.

A short article by G. P. Mills, F.R.C.S. (Birmingham), on tennis elbow to the *British Medical Journal* has aroused the interest of the lay press in quite an exceptional way, more especially as it is an extremely common condition, not only in tennis players and golfers, but in workers in some general trades where strain is put upon the elbow.

There has been much discussion in the past as to its cause but no definite line of treatment has been evolved giving satisfactory results to these sufferers, so they invariably fall into the hands of the osteopaths and bone setters.

Mills' description of the symptoms and signs are brief but to the point. He says, "I found in all the recognised tender spot, which varied in position but was usually just above or below the epicondyle and, as had been described before, that the pain was often produced by complete flexion of the wrist and fingers; also that on superficial examination all movements were complete. When however I specially examined combined movements this was not the case. Frequently for example with full pronation combined with complete wrist and finger flexion the elbow would not come perfectly straight, or if it did come straight there was a distinct feeling of resistance and the process was painful. This is of course a complicated movement but a similar movement of the opposite limb was free and painless. This fact, together with the known frequency of cure by forcible manipulation, strongly suggested that forcing the restricted movement might bring about the desired result.

"My first case was rather dramatic. The patient was a very strong man and I insisted on an anesthetic. Under nitrous oxide I wrenched the arm; with the wrist and fingers flexed and the forearm fully pronated, I forced the elbow into hyperextension, making at the same time firm pressure with my left thumb over the tender spot by the external epicondyle. There was a snap like a pistol shot and the horrified anesthetist insisted that I had broken the arm. The cure was as dramatic as the manipulation."

Mills says that the test of the cure is that the patient can play tennis without pain. He has performed the manipulation both with and without an anesthetic, and so far has had no failure, and in every case has felt a click or snap but not always audible or noisy as in the first instance. His conclusions are commendably short so I take the liberty of quoting them in full.

1. The majority of cases of tennis elbow present characteristic symptoms of physical signs.

2. These cases can be cured by simple manipulation, preferably carried out under nitrous oxide anesthesia.

3. The pathology of the lesion is uncertain but it is suggested that in acute cases a portion of the orbicular ligament may slip between the radial head and the capitellum.

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Burnley, England.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

ALEXANDER J. C. SKENE, M.D., LL.D.

PERSONAL REMINISCENCES

John Cowell MacEvitt, m.d., ll.d.

BROOKLYN, N. Y.

IN this short biographical sketch, it is not my desire to idealize Dr. Skene, as Ian Maclaren in "Beside the Bonnie Briar Bush" idealized his compatriot, the lovable little Dr. Willum McClure of Drumtoochty, although I feel that had Dr. Skene been placed in the same environment among the poor Scottish peasants of the hills and moors of Scotland, he could well have served as a subject for the delightfully descriptive pen of Maclaren as a doctor who loved his fellowman before himself, as did McClure.

I suppose when the dust from the pathway of life rests upon your hair and you perceive the commencement of the evening's glow, you are apt, as I am, to conjure up personalities who in your early career were pioneers hewing their way through the forests of the unknown to reach the open field of gynecology awaiting cultivation.

Looking down the vista now fading into a mist, I gather around me the shades of the Brooklyn gynecologists whom I had the honor to know and to whose councils as a youthful disciple I was admitted. From among this group, I shall select one whose achievements in aid of womankind were recognized and his name glorified, wherever on the globe civilization existed.

Yet these achievements were but part of the man, the greater ones, it is true; but his versatility in the artistic beauties of life (apart from his profession) was astonishingly brilliant.

Brooklyn, the city of his adoption, had just claims to many other medical men possessing international renown, but none lay closer to her heart nor did her civic pride glow with greater warmth than at the mention of the name of Dr. Alexander J. C. Skene. A bronze bust on a marble pedestal, erected on a hillock at the entrance of Prospect Part, testifies to the love and esteem in which he was held by his patients and friends.

Dr. Skene was born in the parish of Kyvie, Aberdeenshire, Scotland, June 17, 1838. His forebears were members of a clan prominent in the annals of Scotch history for centuries. He died July 4, 1900, at the age of 62 years, at his country home, Highmount, Catskill Mountains, New York. His early education was obtained in the day schools of Aberdeenshire and finished at Kings College. In 1877, the University of Scotland conferred upon him the degree of ll.d.

He came to America at the age of nineteen years. Three years afterward he took up the study of medicine at Toronto,

Canada, under the preceptorship of Dr. Alexander McKinnin, the custom of that period. He was a matriculant at the University of Michigan, 1861–1862. In 1863 he received the degree of M.D. from The Long Island College Hospital. His preceptor in the latter instance was Dr. Gilfillan, a noted Brooklyn physician.

With all the love for the motherland which a Scotsman holds, his true Americanism is shown by his voluntary enlistment

FIG. 1. Dr Alexander J. C. Skene (1838–1900).

in the Federal Army, receiving the appointment of Assistant Surgeon in the volunteer corps. He saw active duty at Port Royal, Charleston Harbor, and at David's Island. He became prominent in devising plans for an army ambulance corps, which was the beginning of the system then and now recognized as most essential as one of the humanitarian necessities of war.

Returning to civil life at the close of the war, he entered upon the practice of medicine in the city of Brooklyn where he remained without interruption during his professional career. His ability soon became recognized and within a year he received the appointment of adjunct professor of obstetrics and gynecology at Long Island College Hospital. This appointment brought him more prominently before the medical profession of the country and was the commencement of that career which brought him renown. His generosity and charity kept the emolument from his large clientele within an amount commensurate with maintaining a befitting station in social life.

In reading a biography the reader naturally desires to visualize the physical and personal attributes of the subject. Divesting him of his eminent qualifications, let us view him as a man on the street. He was of medium height, commanding in appearance, emphasized by a wonderful chest development. He was always neatly and soberly dressed, eschewing the sartorial changes in fashion. His gait was slow and measured as he meditatively walked along. His face was of a ruddy tint; his eyes, peering from beneath heavy eyebrows, were inquisitorially bright; his hair, dark and curly, he permitted to grow rather long; his nose was straight and well-formed; his mouth and chin indicated firmness. He wore a mustache, and a beard covered the lower portion of his face.

If you were a stranger, and had occasion to accost him on the street, his eyes and smile would bespeak a cordial greeting. His reply to your inquiry would be such that you would mentally observe, "What a charming, courtly gentleman." If the observation were by a street-sweeper or poorly-dressed individual it would be, "Take it from me, that guy is a good old skate." This homely picture tells its own story.

With his artistic temperament, he loved Nature in all her varying moods. At his country home, away from the turbulence and strife of urban life, he indulged in the lighter literature of the day, modeled

clay, sketched, and chiseled marble. The sculptured marble bust of Dr. Marion Sims, which now adorns the lobby of the building of the Kings County Medical Society, gives evidence that had he pursued the art of sculpture he might have become equally famous.

An outstanding trait in his character was his friendship for the younger men, particularly for those following in his special line of work. Upon one occasion he jocularly observed, "These youngsters are following so close behind me that they kick my heels." One of the younger members of the Kings County Medical Society presented, with fear and trepidation regarding its reception, his first medical essay, entitled "Tubo-ovarian Congestion Simulating Appendicitis." The president called upon Dr. Skene to open the discussion. You can imagine the neophyte's surprise when the doctor arose and said, "I may say, first of all, I appreciate the sagacity of the reader of the paper to select a subject for our consideration of so much interest at the present time. I also appreciate his ability to put together in such a concise form and so briefly many facts that are so suggestive and which especially invite discussion. If I fail to do the subject justice, it is not because the author has not paved the way for me." This was Dr. Skene's method of encouragement for the benefit of other novices.

The graciousness of Skene's manners, his sympathy and kindliness of spirit made him hosts of friends in and out of the profession.

Ye gods! The audacity and presumption of youth! The modesty and benevolence of experience. The writer had under his charge a middle-aged married woman whose home was a three-room flat in a poverty-stricken district of the city. Her husband was a dock laborer. She became incapacitated for work, due to the presence of a large ovarian tumor. She could not be persuaded to enter a hospital for its removal. "I will die first," she said. Her husband was appealed to. He said, "I

know her. When she says she won't, she won't; and that's all there is to it." Finally she agreed to the operation if performed at her home. It was not unusual, at this period, for surgeons to operate at the home of the patient.

The situation was explained to Dr. Skene. "Logically," he replied, "you have but two decisions. If you care to accept the hazard, operate; or, relinquish the case to some other surgeon." I answered,
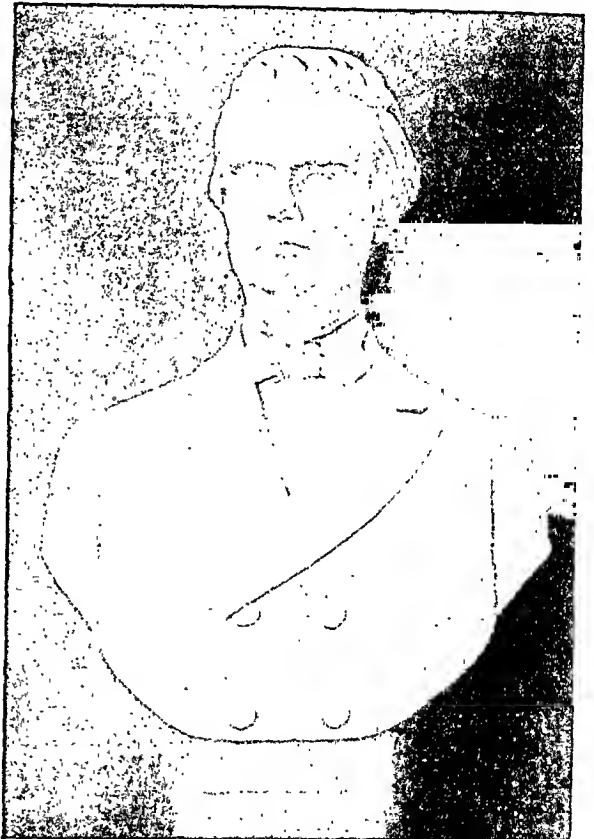
Fig. 2. Bust of Marion Sims, modeled in marble by Dr. Skene. Property of the Medical Society, County of Kings, Brooklyn.

"I would like to operate. Could you possibly find the time to assist me?" "Well! Well!" he replied, adding with a smile, "Maybe it would be just as well for the patient's sake." The genial irony passed unperceived by me in the pleasure of his assent. At this time he was in the zenith of his career and time to him was valuable.

For two days, Dr. Walter J. Corcoran

an assistant of Dr. John Byrne, and myself, washed, scrubbed, and sterilized the kitchen, the room where the operation was to be performed. A complete surgical armamentarium was brought from the hospital. When all was in readiness the patient was placed on the table and anesthetized by a specialist in anesthesia. The scalpel was offered to the Doctor. "You are the operator," he said; "I am the assistant."
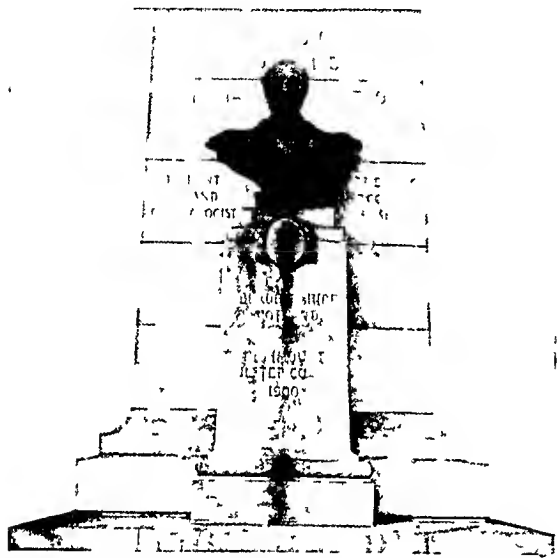
FIG. 3. Memorial to Dr. Skene erected by the citizens of Brooklyn.

A central incision was made. It would occupy too much space to describe the technique of the operation, except to say that it proved to be a multilocular cyst with intestinal, parietal, and omental adhesions everywhere. One knows what that condition means. Dr. Skene, recognizing the difficulty and gravity of the case, assumed charge. The awed, would-be operator and Dr. Corcoran, in silence, acted their proper capacity as assistants. Two hours were required to complete the operation. At its conclusion, Dr. Skene, wiping the sweat from his face, said, "By no means a simple case. My congratulations, doctor." A feather would have dealt me a mortal blow.

It can be truthfully said that no physician in Brooklyn was more liked and admired by his confrères than was he. He was the embodiment of simplicity and strength; he was innately dignified and refined, blind to faults and deaf to the criticism of his fellows.

It is difficult to treat, episodically, his multiple activities for they continuously intermingled. So great were his contributions to medical literature that in a short biographical sketch such as this it would be impossible to enumerate or comment upon them individually.

The late Dr. William Shroeder classified by title over two hundred medical papers, forty-one positions of honor and distinction which he held, and named thirty-one surgical instruments which he devised. The wonder is how he found time, aside from his extensive private practice, to devote himself to so many different attainments. However, a general survey of his more important literary and medical endeavors will be easier of accomplishment.

As a teacher and lecturer he possessed a graceful delivery without any attempt at oratory. In description he was forceful, employing short, terse sentences. His skill in drawing enabled him to illustrate clearly anatomical and surgical problems to the mind of the student. Mindful of their future strife to gain a livelihood, he would take occasion to bring before them the sacredness of their chosen profession, and by word and example to instil the thought that its purpose was the alleviation of the sick and not material gain; to be chivalrous in their bearing toward their competitors; to develop that urbanity and kindliness of manner which bespeak the gentleman, and an encompassing sympathy for the afflicted. On the day he lectured, seats were at a premium. He was idolized by his students. Away from the platform, it was a delight for him to mingle with them; when later, they engaged in practice, he remained their counselor and friend.

As an author he wrote: "Medical Gynecology, a Treatise on the Disease of Women from the Standpoint of the Phy-

sician;" "Education and Culture Correlative to Women;" "Diseases of Women and Children;" "Electro-Haemostasis in Surgical Operations;" "Diseases of the Bladder and Urethra in Women." He discovered the glands which now bear his name; and the knowledge of their existence aids in successfully treating an otherwise intractable disease. Many of his accomplishments were of greater ·importance, yet the discovery of these glands will leave his name imperishable in the annals of medicine.

He was also the author of a novel, "True to Themselves." One evening after office hours, having occasion to visit him, I was ushered into his private library where I found him engaged in writing, with leaves of manuscript scattered over his table. The occasion of my visit settled, as I was about to take my leave, he said, "If you are not in a hurry, I would like to read something to you. I am committing some of my experience to paper in the form of a novel. Give me your opinion as to how this reads." Taking from a drawer some completed manuscript, he read for an hour or so, excerpts from his composition, "True to Themselves." I fear I was more elated with the compliment than interested in the story. He was undoubtedly inspired to emulate Dr. Oliver Wendell Holmes and Dr. Weir Mitchell, but he did not quite catch their imagery or wizardry of diction. He called it "A Psychological Study." A more correct title, in my opinion, would have been "A Romantic Psychological Autobiography."

In an editorial capacity, he was a collaborator of the following publications: *Achives of Medicine, American Medical Digest, New York Gynecological and Obstetrical Journal, Journal of Nervous and Mental Diseases.* He was also a corresponding member of the following foreign societies: Société Royale des Sciences Médicales et Naturelles de Brusselles, Die Gesellschaft für Geburtshülfe zu Leipzig (at the celebration of their four hundredth session), Société Obstetricale et Gynecoligique de Paris, Edinburgh Obstetrical Society. (Honorary Fellow of), British Medical Society.

All of his writings display an ease in composition. He expounded his text with a vigorous simplicity, lucid in detail, and felicitous in expression. It required no deep concentration to grasp his meaning. His talent for description placed before the reader a distinct picture. He wielded his pen with the same infinite grace as he did his scalpel,—both cut cleanly.

As a gynecologist and surgeon, he entered the field of gynaesic abdominal surgery at an epochal period. From the time of Dr. Ephraim McDowell, who published the first authentic report of ovariotomy in 1809, until 1864 it was a debatable procedure. In 1921 Dr. Nathan Smith, of this country, operated successfully, tying the pedicle with ligatures cut from the Doctor's buckskin gloves. In 1872 Robert Batty of Georgia performed an ophorectomy for the removal of healthy ovaries to cure dysmenorrhoea. In 1851 Grenzer, a German surgeon, wrote that most ovariotomies within the last forty years had had a fatal termination and as a consequence reliance could not be placed in its successful performance. Confidence was altogether shattered when the celebrated surgeon, Dieffenbach, declared against it. Kiwisch, about this period, collected statistics of 54 cases of which 51 ended fatally. In America and England no such number of fatalities occurred; and in this country, particularly, the mortality lessened with increasing rapidity. In 1852 Dr. Edward Martin declared that the questions of propriety and expediency of ovariotomy was but of conditions favorable to success.

With the advent of asceptic surgery, improvement in technique, instruments of precision (of which Dr. Skene invented many), the prominent surgeons of America operated without fear of fatal results. As we now look back and recall discussions of the leading gynecologists, we can see how gradual was the improvement in technique to attain its present status.

Consider how slowly and carefully the incision was made in the opening into the abdominal cavity, the postoperative flushing of the cavity with pitcherfuls of water, the cauterizing of the pedicle with the paquilin or galvano cautery after its ligation with braided silk thread, the attaching of the stump to the abdominal wound, the drainage in non-septic cases by glass tubes formed to follow the curve of the uterus, and the use of the combined abdominal and vaginal gauze drainage to an extent of producing sometimes a mild form of iodoform poisoning. The foregoing incidentals of technique were overshadowed by the fear of the advent of septicemia, peritonitis, hemorrhage, or shock.

Passing Long Island College Hospital one morning, I met the Doctor. "Good morning! I am about to make my rounds. Come along." In his tour he brought me to the bedsides of six women upon each of whom he had performed an ovariotomy and who were then far advanced in their convalescence. Knowing the results of other leading surgeons, I felt that I was in the presence of a master surgeon.

In the beginning of his abdominal surgery work, he was timidily progressive, carefully studying the history and the individuality of each prospective ovariotomy. In time success gave him assurance for that celerity in operating for which he was noted, and permitted him to give play to the exercise of his originality. He lacked the laboratory of today in aid of diagnosis, but he had that intuitive mental endowment, that vital something, that creates the great artist and the great surgeon.

It was said of him that few operators were able to handle surgical instruments with greater dexterity than he. "That his technique was so quiet and singularly simple, only a brother surgeon could appreciate its speed and thoroughness." If when operating, some unexpected pathological condition appeared, there was a momentary hesitation and the difficulty was decisively met. He never seemed perturbed or irritated. He worked with the placidity of a deep flowing stream, preserving an even poise from the commencement to the completion of the most difficult operation. Dr. Skene was a splendid surgeon possessing all the fundamental virtues of a Christian gentleman.

BOOK REVIEWS

We have so many worth while books to tell you about this month we shall waste no time in fashioning an introduction but go right to the subject matter.

Doctor Thomas Kirwin kindly reviewed William F. Braasch's "Urography." His article reads:

UROGRAPHY. By William F. Braasch, B.S., M.D., F.A.C.S., in collaboration with Benjamin J. Hager, B.S., M.D. Ed. 2, revised and enlarged. W. B. Saunders Co., Phila., 1927.

Though intended especially for those restricting their professional activities to urology, this treatise should make an equal appeal among internists and general practitioners; indeed, it would not be too much to say that what it contains is of the most vital interest to every individual engaged in the treatment of disease of the human body, wherever located. While produced as a second edition of the author's "Pyelography" published in 1915, this is to all intents and purposes an entirely new exposition of the subject, so great have been the advances made in this special form of diagnosis during the past ten years.

In his position as head of the urologic department of the great Mayo Clinic, the author has an almost unequaled amount of clinical material upon which to make observations. That he has made good use of his opportunities the 759 roentgenograms which he has selected to illustrate the exposition of his technique and results bear graphic witness. Only those who have devoted much of their professional energies to the interpretation of roentgenograms of the urinary tract and the application of the information therefrom derived, can truly appreciate the inestimable value of what is so lavishly placed at our disposal. Yet he who looks at a pyelogram for the first time will

immediately recognize that the opportunities for comparison and study which the material contained in this volume offer can be equalled nowhere else outside of an exceptionally large clinic such as the one which made the compilation of such a treatise possible.

The chapter on the normal renal pelvis is very valuable, but it would seem that even more attention could have been given to this subject without emphasizing too strongly the vital necessity of being thoroughly familiar with the normal before attempting to recognize and interpret the abnormal. Of especial interest are the often brief suggestions as to typical pathologic appearances, as the "typical lobulated diffuse shadow occurring with calcareous renal tuberculosis" depicted in Fig. 301, and many others. The plan of arranging the plain roentgenogram first made beside the exposure after an opaque medium had been injected, illustrating graphically how easily grave errors may arise when reliance is placed upon either one alone, is most excellent. Another reason every reader should feel grateful is that the author has not hesitated to record his errors and to deduce therefrom means by which those who follow his teachings may be saved from doing likewise. His warnings as to situations where the employment of urography is unwise are as emphatic as those of its most persistent opponents, and the reader involuntarily feels greater confidence in following the lead of one who never permits the enthusiam which he feels for his subject—abundant existence of which is furnished by every page—to run away with his sound judgment and dispassionate estimate of the limitations and pitfalls by which it is surrounded.

The make-up of the volume leaves much to be desired. The busy practitioner would find it of easier reference if sub-titles were made more prominent and the index were more complete. Often one must thumb over many pages before coming upon the exact bit of information or the particular figure which he needs in his daily clinical rounds. These are minor blemishes in a work of such value as to defy estimation, but it is to be hoped that another edition may give greater attention to these mechanical details, making the former worthy of the material it presents.

When we received the *Italian Archives of Surgery*, commemorating Dr. Raffaele Bastianelli's twenty-fifth year of professorship, his friend, Dr. Paola De Vecchi was appealed to do the review which follows:

Archivio Italiano di Chirurgia, xviii. Scritti in onore di Raffaele Bastianelli, nel xxv anno di insegnamento. 8vo. Paper. Pp. 711; illus. Bologna, L. Cappelli, 1927.

A testimonial anniversary of his twenty-fifth year of professorship was given to Dr. Raffaele Bastinelli of Rome by his old pupils, and his many friends and admirers in Italy and in foreign countries, among them some prominent American surgeons.

Many of these colleagues contributed original articles on medical and surgical subjects, which were collected and published in the *Italian Archives of Surgery*, directed by Dr. Mario Donati and edited by Licinio Cappelli of Bologna.

This volume is a credit to the editor as well as to the committee of arrangement, and in the 700 neatly printed pages collects some very valuable papers on different phases of surgery. The articles are fifty-four in number, of which six are from American surgeons, one from an English and three from French surgeons.

It is among the first works of this kind, published as it is for a testimonial to one man who has won an international reputation for his constant work in the field of scientific and practical surgery and who has contributed to surgical progress in the last score of years.

Dr. Raffaele Bastianelli is well known among the professional men of America, for on many occasions while visiting the schools of medicine in this country he has delivered interesting lectures on various surgical subjects.

In Rome he is the leading surgeon, and many of our American colleagues while visiting in that city have had the opportunity of enjoying his hospitality, as well as assisting at some of his brilliant operations. These operations have been performed first at the Polyclinic where he delivered lectures for twenty-five years, and more recently at his private sanatorium, where he continues to practice and teach modern surgery.

The surgeons from this country who have contributed original articles to this volume are Dr. F. H. Albee, on extraarticular arthrodesis in tuberculosis of the spinal vertebrae, hip-joint and sacroiliac joint; Dr. W. J. Mayo, on surgical diseases of the spleen; Dr. E. Starr Judd, on colecystitis; Dr. E. Beer, on the clinical and pathological analogies between the

urinary and biliary tract; Dr. J. C. Bloodgood, on acute and chronic dilatation of the duodenum and on gastroenteric ileum; and Dr. Vincent Gaudiani, on how to deal with the ureter in its extravesical insertion.

We were under the weather one week-end and occupied our time with a perusal of the several good books, the first of which is:

REBUILDING THE CHILD, A Study in Malnutrition. By Frank Howard Richardson, A.B., M.D., F.A.C.P., containing an introduction by Wm. R. P. Emerson, A.B., M.D., Professor of Pediatrics, Tufts College Medical School, Boston. G. P. Putnam's Sons, N. Y., 1927.

We copy the blurb on the cover, "This book is a study of the vast number of school and preschool children who are for some reason below par, over-tired,—in a word, falling short of the joyous, abundant health that is the birthright of every child . . . he [Dr. Richardson] addresses himself,—'The four learned professions of Parents, Teachers, Nurses and Doctors!'"

This is a popular book inasmuch as layman or physician may read and enjoy, absorb and comprehend. The blook is 319 pages long and has 44 illustrations, for the most part from actual photographs.

Such topics as An Old Disease in a New Garb, Making the Diagnosis of Malnutrition, Faulty Health Habits, Family and School Strain, Physical Defects, Fatigue, The Nutrition Class, Home Treatment, Malnutrition and Measured Feeding, Nutrition and the Overweight Child, Posture, Mentality and Malnutrition, The Cure of Malnutrition, and What Has Been Written about Malnutrition, have been done in a manner that will appeal to the parent and the general practitioner. We omit the specialist in pediatrics as this book to him would at best be juvenile. But the rest of the world may follow the written lines and here and there find a pearl of knowledge and wisdom.

The next to engage our convalescent minutes was:

THE ENDOCRINES IN GENERAL MEDICINE. By W. Langdon Brown, M.A., M.D., F.R.C.P., Physician to St. Bartholomew's Hospital, London. Paul B. Hoeber, Inc., N. Y., 1927.

The first sentence of the Preface reads, "In this book I have attempted to give a brief account of the endocrine system and its diseases in a form which I hope may be of service to the general practitioner."

Doctor Brown has lived up to that promise and, in addition, has written an engrossing book on what, to many, is a deep subject. Why so many physicians look upon the general topic of the endocrines as something to avoid and leave to the other fellow is a mystery. Surely merely because the study as a whole is in its infancy and yet governs such a large part of general medicine, it should attract the majority of the men in practice.

This book is chiefly a record of Dr. Brown's personal experience, first in the laboratory, later at the bedside. He has linked the physiological and clinical methods, and given an account of the biological position of the endocrine system in relation to the viceral nervous system.

The book begins with a chapter on the biology of the endocrine system. Then the endocrine system in childhood is covered. There follows chapters on the thyroid gland, the parathyroids, the pituitary body, the adrenals and the chromaffin system, the retarding glands, the endocrines and the gonads, the endocrines and general metabolism, the endocrines and the psychoneuroses, endocrine therapy, and the future of endocrinology.

The book is engaging in style. Parts of it read like a good novel, as, "We ordinarily think of the evolution of the nervous system as peacefully accomplished. A struggle between two animals or two species we recognise. But it would appear that a similar struggle accompanies the integration of the multicellular individual. Many apparently peaceful events in nature prove on closer analysis to involve a concealed struggle. Man is a gregarious animal, but he has not found it an easy task to adjust the desires of the individual to the needs of the community. Philosophers may lament this, theologians may attribute it to original sin, but it should lead the biologist to enquire whether the cells of which he is composed have always found it easy to sink their individuality in that of the organism."

After one has read this book he will have a good and workable knowledge of the subject. To be a good surgeon, gynecologist or internist, one must be on more than speaking acquaintance with endocrinology. To have had a book done on this topic that covers the ground thoroughly, giving the meat of the subject and forgetting the trimmings of speculation,

giving it to us in a style distinctly literary, and boiling the whole down to a hundred and forty-four pages, which includes an index, makes it a work that should find favor with the profession at large, a book that should grace many libraries.

The third book made a dull Sunday pass more swiftly. We refer to:

APPENDICITIS. By Hubert Ashley Royster, A.B., M.D., Surgeon to Rex Hospital; Surgeon-in-Chief, St. Agnes Hospital, Raleigh, N. C.; Former President Southern Surgical Association. Surgical Monographs, Under the Editorial Supervision of Dean Lewis, A.B., M.D., Director of Surgery, Johns Hopkins University; Eugene H. Pool, A.B., M.D., Attending Surgeon, New York Hospital; Arthur W. Elting, A.B., M.D., Professor of Surgery, Albany Medical College. D. Appleton and Company, New York, 1927.

Doctor Royster in his preface says in part, "The purpose of this monograph is to present a study of inflammation of the veriform appendix . . . Within the past few years no treatise on the appendix has appeared, while the numerous articles published in medical journals lack correlation and need integration in the light of more recently acquired knowledge and of enlarged experiences . . . This monograph is an effort based on the hope that it will clarify the questions which have been brought to the surface by the shifting period which is now present in our attitude towards appendicitis and that the writer's endeavor to stabilize contemporary opinions will be welcomed."

This book is welcomed to the company of all good books. We hope it will be widely read, especially by the general practitioner and the man who believes in trying to prevent or cure appendicitis by "freezing" it.

The book opens with a heading, "'Last Words On Appendicitis.'" The first quotation is from the pen of the late John B. Murphy, written in 1915, "Is it time to stop talking about appendicitis? No! It is just the time to begin talking about appendicitis and talking most seriously and emphatically about it."

To which the reviewer cries out a loud, "Amen!" in the year of our Lord, 1927.

Chapter I deals with a historical sketch of appendicitis. Perhaps we have a weakness for things historical. We believe one is not cultured in his profession or speciality unless he

has acquired a thorough knowledge of the historical background of his calling. And so this sketch on the history of appendicitis is fascinating reading.

The anatomy of the cecum and appendix follows, and is recommended to surgeon and internist that their anatomical memories may be refreshed. A chapter on Physiology is next in order, and in its train comes Etiology, Pathology, Symptomatology, Diagnosis, Complications, Appendicitis in Children, Prognosis, and Treatment.

Topographically the book has been well done. In length it is 370 pages, with 56 illustrations and two colored plates.

We earnestly and seriously recommend Dr. Royster's monograph to many Doctors of Medicine.

The last book to engage attention and so close the review for this month is:

NASAL NEUROLOGY, HEADACHES AND EYE DISORDERS. By Greenfield Sluder, M.D., F.A.C.S., Clinical Professor and Director of of the Department of Otolaryngology, Washington University School of Medicine, St. Louis. 8 vo. Cloth. $11.50. Pp. 428; 167 illus. C. V. Mosby Co., St. Louis, 1927.

Sluder's book is a contribution both to clinical medicine and anatomy: to the former because of its content of valuable clinical experiences and ideas and to the latter through the suggested points of attack in anatomical research.

It is a compilation of the previously published works of the author on the referred pains produced by sinus disease, with many additional comments. Most extensively treated are the experience of Sluder and others, both corroboratory and contradictory, in vacuum frontal headache, "anterior ethmoidal neuralgia," "lower half" headache and the neurological sequelae of hypertrophic sphenoidal sinusitis.

Each of the four main conditions dealt with is introduced in an anatomical substraction, as fully presented as present knowledge will permit, and is developed through clinical, diagnostic, pathologic and therapeutic treatises. There are chapters in surgical technique, and a brief one in orbital abscess. The observations in injection of the nasal ganglion for various sorts of pain—the "lower half" headache in particular—are perhaps the most interesting and suggestive.

In this decade, which has been so lightly given over to fantastic and general accusation of the sinuses for almost every form of symptom and lesion, it is astonishing that so little sound fact on the question has been gleaned. It may be hoped that Sluder's work may begin to stem the flow of conversational pathology about the sinuses, and orient future thinking on the subject along more rational and anatomical lines.

The chapter on "Some Neurological Problems in Rhinology" gets away from actual observation into speculation which does not seem very valuable.

We come to a book that is not scientific and yet has a direct appeal to the physician. MOTHER INDIA. By Katherine Mayo. Illustrated. Harcourt, Brace and Company, New York, 1927.

It is a best seller among books listed as non-fiction, and justly so. Recently there has arisen a keen discussion whether or not the author has 'distorted the facts and has drawn a true picture. Unless one has gone to India and knows conditions at first hand, he is in no position to take sides. It is best for the reader to follow the pages and form an opinion.

The physician will be interested in the custom of child marriages, native obstetrics, public health work, and the weird superstitions of the native people. It is fascinating reading and we warn every physician who buys a copy to read it before the other members of the family discover it, for, once it becomes family property, the saying, "possession is nine points of the law," will become a reality.

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EDITOR: THURSTON SCOTT WELTON, M.D., F.A.C.S., NEW YORK

IN THIS ISSUE:

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The American Journal of Surgery

CONTENTS—MAY, 1928

ORIGINAL ARTICLES

·The American Journal of Surgery·

CONTENTS—MAY, 1928

Continued from page i

General Information page iv
Index to Advertisers page xx

THIS MONTH'S CONTRIBUTORS

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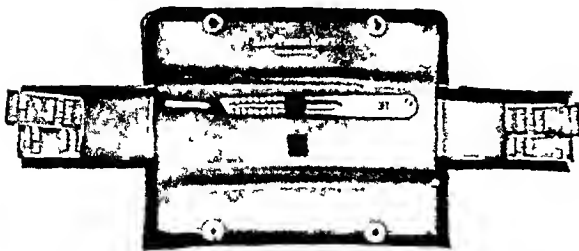
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LINCOLN, NEBRASKA

I N presenting my thoughts to you upon this subject I do so largely with the hope that the methods which I propose may be considered and improved upon in such a way that our specialty may become more useful, and that success in these difficult cases may become more general than could be possible without your interest and your help.

As matters stand in surgical practice at the present time, every doctor who puts a piece of soiled gauze wet with Dakin solution or any other antiseptic into an infected wound feels that he is practicing the sort of antiseptic surgery for which we are indebted to Sir Joseph Lister. In some degree we have all fallen into the same error. We dip our soiled hands or our instruments into weak antiseptic solutions, we lave our infected wounds with solutions that become inert in a moment, and we trust the germs somehow for hours following to curl up and lie dead. The kind of antiseptic surgery that is now practiced, especially that which has to do with infections of bones and joints, has too little resemblance to Listerism to deserve the name. It is mostly not as well done as in Lister's time

Aseptic surgery, the prevention of infectious surgical complications, has vastly improved in the perfection of its technical details since Lister showed us the way. Our methods of dealing with infected wounds, however, have not improved to the point that our knowledge should have carried us. We still have mixed infections, prolonged suppurations, delayed healing and permanent disability due to protracted infections that are preventable, unjustifiable, and to a large extent, a reproach to surgery.

In order to formulate the matters that I wish to discuss, I wish to submit the following general propositions:

1. Our results in acute and chronic infections of bones and joints fall short at present of what we have a right to expect in such cases.

2. Poor results in such cases are due to one of the following:

Failure to afford early and adequate drainage of the infected area.

Secondary and mixed infections.

Failure to protect the parts against harmful motion and preventable deformity.

3. Extension of the primary infection, mixed infection, secondary foci, delayed healing, deformity, and permanent disability may all be prevented or controlled to a large extent by a method to be described.

The attempt to improve our methods in dealing with infections is difficult because

it has been generally supposed that our aseptic and antiseptic methods have already reached a high degree of perfection. Especially since the introduction of the Carrel-Dakin method, it has been assumed in many quarters that no better method of dealing with infected wounds could be hoped for. One must say that some of the demonstrations of this method have been very beautiful, but in general the attempts to use this and other forms of "active antisepsis" give results no better than, if as good, as those obtained by Lister with his carbolized beeswax dressings done "under the spray." It will surely have been your observation that osteomyelitis and compound fracture patients who come late to you for reconstructive surgery present great damage from infection and great disability from lack of enforcement of the principles of deformity prevention which are the fundamentals of orthopedic practice.

My point is this, that although the principles of asepsis (I shall not say antisepsis) are well known to us and although methods of immobilization in correct position are available to anyone, it is the exceptional surgeon only who observes and employs these principles and methods in dealing with his patients.

The treatment of wounds in general at the present time, in spite of our war experience, has not progressed very much beyond what was being done at the end of the last century. The efforts to provide rest in the best sense for injured parts has in a large measure given way before the supposed requirements of the antiseptic method for wound treatment.[1] Splinting

for immobilization has yielded to any compromise that will permit the use of wet packs, irrigation, frequent changes of antiseptic dressing, etc. Neither the wound nor the injured part is thus given an opportunity for rest.

Some of our difficulties in treating infected wounds have arisen out of the fact that in discussing character of infection, number of organisms, selection of antiseptic, etc., we have lost sight of the general principles referred to. Consequently, even if rigid asepsis is observed at the time of operation in dealing with osteomyelitis or a compound fracture, it has become the universal custom to reinfect these patients daily or twice daily by what we are pleased to call antiseptic dressings—which never are antiseptic. Moreover, in our enthusiasm for these more complicated kinds of antiseptics, we not only disturb the wound surface and add to the bacterial flora but we disturb the entire area and even go so far as to forbid protective casts and splints. Also we add further injury to the patient by leaving irritating chemicals in contact with the wound surface in an attempt to destroy in the wound by direct antisepsis infection that should not have been permitted to be there. The result of all this is failure to prevent deformity, profuse discharge, unnecessary suffering and delayed healing unless the patient has a high degree of resistance to irritation and infection and recovers in spite of it.

Following the lead of Lister, our ideal has always been to secure healing of the wounds without the appearance of a purulent discharge. The cleanliness of the wound has been one of the great factors in the popularization of the Carrel-Dakin method. I have become convinced, however, that in many cases the fact of a moderate amount of discharge, even if

[1] "The treatment of a compound fracture must be divided into two parts: (a) the cleansing of the wound and (b) the setting or reduction of the fracture, followed by its maintenance in good position. In the early stages the first is by far the most important, and on its attainment depends, within limits, the success of the second.

Total immediate reduction is good and is to be aimed at provided it can be carried out without prejudice to the cleansing of the wound but an incomplete reduction, or even no reduction at all, may be advantageous by aiding the disinfection of the wound. Surgeons working at the front are therefore mainly concerned with the primary cleaning of the wound and with the means to transport a patient to the base with comfort and without detriment to the wounded limb." (Bowlby, A. A., and Wallace, C. Abstract of war surgery. Brit. M. J., 1917, p. 44.)

purulent in character, is of much less moment to the patient and to the healing of his wound than protection against motion and irritation of the injured part, reinfection by exposure for frequent dressings, and loss of position in a part where there is a tendency toward deformity. I have permitted a discharge quite profuse in character to be in contact with a wound for several weeks and found good progress in healing during the whole time.

The whole matter of frequent wound dressings is very thoroughly disposed of by Sir Almroth Wright in his book on "Wound Infections."[1] It is there very clearly pointed out that the frequent redressing of wounds is quite inadequate and unreasonable and that finally the application of antiseptics quite frequently does harm rather than good. The harmful effects pointed out by Sir Almroth, however, are chiefly physiological as related to the wound and the immediate wound area and have to do with the granulations, the movements of the leucocytes and microbial growth.

If so little is accomplished for the wound itself by the application of antiseptics, certainly it seems highly unreasonable to inflict such dressings upon the patient in view of the other disadvantages that have to do with the hematogenous distribution of infection—muscle spasm, pain, deformity, etc. These violations of general as well as local rules involve the neglect or violation of orthopedic principles of treatment for injured or inflamed parts at the same time.

In Wright's advocacy of wound treatment by physiological methods (page 64) physiological considerations chiefly in connection with wound treatment are put forward. At the same time free incision and dispensing with sutures as well as the application of physiological solutions are urged. Unfortunately, no provision is made for physiological rest for the wound or for

[1] Wright, A. E. Wound Infections. N. Y., Wm. Wood & Co., 1915. p. 49 et seq.

the part such as we as orthopedic surgeons consider to be necessary. With his treatment by vaccine therapy I do not feel competent to deal. I am constrained to remark, however, that fortification of the patient against infection by specific antitoxins has been fully demonstrated to be good treatment. If specific antitoxins can be developed for all the germs that cause our numerous septicemias, we shall be extremely fortunate. At the present time these are certainly not reliable to any considerable extent.

When Sir Joseph Lister proposed the antiseptic method for the treatment of infections, surgery as a profession as well as surgical patients were in great difficulties. Septic fever, hospital gangrene and pus were the expected accompaniment or sequel of every injury and every surgical procedure. Through the influence of Lister all that has been changed. Primary healing of wounds after aseptic operations may be expected with certainty if the rules of asepsis and antisepsis are observed.

Lister not only thought out but also worked out methods for the prevention of infection. If there may be said to be a weakness in the antiseptic system which developed either in Lister's time or since, it is in the fact that in proceeding from the prevention of infection to the control of infection there has been lost the strict observance of the rules which Lister himself laid down. Every one will admit that we still have entirely too many operative and postoperative infections. I think we must admit also that these infections are due to failure to prevent either primary or accidental secondary infection. Moreover, additional industry in antiseptic research, that is to say, the trying out of new antiseptics and more and more complicated dressings, has added to the irritation of wounds and to the disturbance of parts until it is high time that we should make a plea for rest for the wound and for the injured part rather than for additional varieties of disturbance.

We must admit that in general a high

degree of success in the prevention of infections in operations upon the abdomen and upon the soft parts has been attained. The number of infections in bone and joint operations, both primary and secondary, has been entirely too high and we must all feel that it is necessary for us to improve our methods if we are to make progress in this special field of surgery.

Listerism, as applied to the performance of aseptic operations, has been perfected and improved to a remarkable degree. But Listerism, as applied to the treatment of infected wounds in general practice is scarcely as good as in the days of Lister himself. It must always be remembered that Lister conceived of antisepsis as a means of preventing rather than controlling putrefaction. In his own words, "it is hardly needful to point out that neither the spray nor the carbolic oil applied externally nor the oiled lint inserted in the outlet to serve as a drain could correct putrefactive fermentation once established in the abscess cavity. Here, as in the antiseptic treatment generally, the means are calculated to prevent, not to correct, putrefaction."[1]

Lister says further: "If we treat our wounds by means expressly calculated to exclude altogether the entrance into them from the first to last of minute organisms, not only are the specific diseases got rid of, not only do hospital gangrene and pyaemia, those scourges of former surgery, fly away as at the touch of the enchanters wand to trouble us no more forever, while septicemia also vanishes, and erysipelas, though more stubborn, is robbed of its terrors—not only, I say, do these diseases, recognized as specific, disappear, but, if the treatment is properly conducted, we get rid of inflammation altogether; and we see wounds that are left with their edges widely gaping, and become occupied with a substantial blood clot, heal, it may be, without a particle of pus, a cicatrix forming beneath the superficial layers of coagulum.

[1] Collected Writings of Lord Lister. N. Y., Oxford Univ. Press, 1909, i, 400.

"The times of changing the outer cloth, or treating it with fresh oil, should be in accordance with the amount of discharge. During the first twenty-four hours the effusion of blood and serum is necessarily profuse, and it will be well that fresh oil be applied to the outer cloth within twelve hours of the first dressing or even in six hours if there should be unusual oozing. On the second day, also in the case of a large wound, two dressings in the twenty-four hours will be desirable. After this, if all goes well, the discharge will diminish quickly, and a daily renewal of the antiseptic supply will be sufficient; and when five or six days have passed, to apply the oil once in two days will be all that will be required. This, however, should be continued after discharge has ceased entirely, till sufficient time has passed to insure that the wound has healed by scabbing, or at least has been converted into a superficial sore."[1]

Although Lister investigated many substances, he did not find any so generally used as carbolic acid, until after the publication of Koch's work on antiseptics in 1881 he was led to examine the salts of mercury. He found that some of these were, under certain circumstances, as useful and much less irritating than carbolic acid, and that being the case he restricted the use of carbolic acid greatly.

"In arguing in favour of the meticulous care that Lister took to avoid sepsis, and of the theoretical basis of the treatment on which Lister's method was founded, one used often to be met with the statement that healing without suppuration or septic disease was no new thing, and that therefore Lister's views could not be accurate. Some asserted that any increased success which Lister obtained was essentially the result of increased simple cleanliness (apart from disinfection) that Lister's method entailed, and as time went on those surgeons who were particularly careful as to cleanliness were able to bring forward very striking results in

[1] Ibid., ii, 161, 162, 163, 227.

favour of this view. And there is no doubt that there is much truth at the bottom of this contention. For even simple cleanliness (and by that I mean simply washing with soap and water) means a very great advance over the state of matters which prevailed before the Listerian period."[1]

Reduced to its simplest terms, Lister's teaching was that by the use of antiseptics infection could be excluded from surgical or accidental wounds. In a surgical wound, this may and should mean, the exclusion of all infection. Lister has certainly taught us that we may exclude from a wound infected from any cause additional infection of the same kind or new infection of a different kind. For the large majority of patients this would mean an uncomplicated recovery. But this teaching has usually not been observed. Such methods of wound treatment as salt packs, the La Porte method, the Carrel-Dakin method, etc., which have gained popularity for one reason or another, are nearly all open to the objection that they interfere with such protection of the wound and adequate immobilization of the damaged parts in correct position. It is the opinion of the author that the two points to be kept constantly in mind in connection with these cases are protection of the wound and immobilization of the parts. This is with the understanding, of course, that primary drainage and cleaning up of the wound have been adequate and satisfactory. Secondary abscess in bone and joint infection is due either to direct inoculation of the skin at places remote from the primary lesion or to hematogenous transmission of material from the original infection. Secondary infections in the manner first mentioned should not, of course, occur. Secondary infections by hematogenous transmission of organisms from the original focus may be prevented much more often than we realize if the wound surface is let alone and if the

inflamed area is adequately immobilized during the inflammatory period.

The exact technique which has been worked out to comply with the requirements proposed is as follows:

1. Make a fairly large incision over the infected bone area. Spread apart the skin, muscles, fasciae and periosteum just far enough to afford access to the diseased area and no farther.

2. Chisel a window into the infected bone area large enough so that adequate drainage is provided and that all dead bone may be removed and so that there are no overhanging edges of bone over the diseased area.

3. Clean out the diseased area gently with a curette or gouge, being careful to refrain from unnecessarily damaging the tissues undergoing repair.

4. Dry the wound and wipe out with 10 per cent iodin followed by 95 per cent alcohol.

5. Pack the entire wound wide open but not tightly with a sterile petrolatum gauze pack. Cover this with a dry sterile pad and bandage on.

6. Now perform any reasonable forcible manipulation necessary to place the parts in correct anatomic position for splinting.

7. Apply a plaster cast, preferably, or a suitable splint so that the parts are thoroughly immobilized in comfortable and correct position.

8. Finally the cast is not to be split nor are windows to be cut until the wound dressing becomes necessary. And the *wound is not to be dressed* at all unless there is a rise of temperature or other signs of acute sepsis. As a rule, no dressing is necessary except on account of odor and this may not be required for several weeks. In a majority of cases the patient treated by this method will go through to complete healing with a few dressings at intervals of from ten days to four weeks.

It is to be noted that the great improvement in the treatment of wounds during the great war was coincident with and

[1] Cheyne, W. W. Lister and His Achievement. London, Longmans, 1925, p. 100.

consequent upon the improvement in the early splinting and more careful transportation of the wounded. With the organization of splint teams at the front and the more careful handling of the wounded from the moment of injury, the care of wounds became a much simpler matter and recovery was much more rapid than formerly. It was the unanimous opinion of those who were in a position to observe the effect of prompt splinting on these patients that the amount of shock was greatly reduced, that many lives were saved entirely as a result of these prompt methods of splinting and that wounds were in much better condition for the same reason.

One of the most interesting applications of the treatment of infected bone wounds by rest is to be found in compound injuries and osteomyelitis of the tarsus and adjacent portions of the foot and ankle. One of the first cases of osteomyelitis treated by Lister by the antiseptic method was one of the tarsus. The foot healed in a most gratifying manner and afforded a striking contrast to the results in similar proceding cases. In this class of cases even now amputation or severe disability has been the rule because of the extensive incisions that are commonly made in an effort to establish drainage of the foot, ankle and leg, the attempts to combat infection by wet antiseptic dressings and the failure to apply mechanical devices for the maintenance of correct position of the foot and leg.

Some of my own most gratifying results obtained by the application of the principles of rest to wounds and infections of this sort have also been obtained in the foot. Adequate drainage in any stage of compound or infected fractures with the foot maintained in correct position in plaster has given the most gratifying results. In this way healing in correct position in a very short time can be obtained and, although there is a certain amount of bone deformity, the patients have been found to have useful and painless extremities. The following is an illustrative case:[1]

Miss E, nurse, aged twenty-one, developed an acute inflammatory condition in the left foot in January, 1923. The foot was immediately incised but local and general sepsis progressed. Further incisions were made in all parts of the foot and leg following the tendon sheaths and fascial compartments, as is customary in such cases.

I saw her at the end of the seventh week. She was in a serious condition with an enormously swollen leg which had been freely incised and continuously fomented or irrigated for weeks. She had marked hip, knee and ankle contracture. The foot and leg were badly macerated and very foul because she would not tolerate any cleaning up measures. Roentgenogram at this time showed a destructive bone lesion involving the tarsus which had apparently never been drained. (It may be mentioned that at this time the pain was so severe that she was receiving $\frac{1}{4}$ grain of morphine every four hours.) Upon my advice she was taken to the operating room and a thorough drainage operation into the tarsus was done. A good sized abscess was found and cleaned out. The wound was packed well open with vaselin gauze and then the hip and knee were straightened out. With a little force the foot was brought up to a right angle with the leg. All of the other open incisions were merely wiped off (or out) with iodin and rinsed with alcohol. A sterile sheet cotton bandage was put on over the gauze dressing and a long cast was put on. The patient was put to bed with the leg in suspension and traction. For the first day or two she still clamored for morphine but received none after the third day. At the urgent request of her previous surgeon I did a dressing on the tenth day. There was no discharge and the wound looked healthy. None of the other incisions gave the slightest trouble. This patient was in the cast for about three months. Then a posterior iron was put on. The wound was entirely healed and remained so. There is a little equinus and varus deformity but with a special shoe no disability whatever. For the past two and one-half years she reports that she is able to do as much on her feet as she ever did.

[1] Previously reported. ORR, H. W. Treatment of osteomyelitis and other infected wounds by drainage and rest. *Surg., Gynec. & Obst.*, 1927, xlv, 446.

In considering methods of primary and secondary closure of septic wounds, one important point has sometimes been overlooked; that is, that even in wounds that are apparently quite clean and in which cultures indicate a great decrease of the number of organisms, there are still pockets of infection deep in the tissue, the condition of which is not shown by the cultures taken from the surface. When these pockets are covered up, subsequent irritation is likely to cause a renewed activity at the point of these small septic pockets. Indeed, it has been quite common for such cases, closed after thorough Dakin treatment, to break down and give new trouble.[1]

Even if such a method as the Carrel-Dakin were adequate for the treatment of infections of bones and joints, and if the use of splints were unimportant, and plaster casts could be dispensed with, I should still consider it too difficult a technique for general employment.[2] The

highly complicated methods that can be employed by competent surgeons will not do for recommendation to the profession at large. There is sufficient evidence of this even in the matter of the performance of simple aseptic procedures in which unfortunately too many failures still occur. It is certainly to be considered, therefore, that any method which simplifies the care of infected wounds and which requires the keeping off of hands and instruments on many occasions has much to recommend it. If, as I have suggested, a compound injury to a bone or joint may be cleaned up once and then let alone for weeks, the patient's chance for escaping secondary and chronic infections has certainly been improved.

There is at times some misunderstanding as to just what it is that makes the method that I propose different from others that have long been employed. Some have thought that I advocate a new type of operation, others that I consider the use of vaselin plugs to be original, and still others that I claim to be the first to employ infrequent dressings. None of these suppositions is correct. A combination of measures is considered to be essential to successful treatment of these cases. These measures are as follows: (a) adequate drainage, (b) primary aspesis or antisepsis, (c) a non-absorbent, non-irritating dressing which will exclude infection from the wound, (d) avoidance of secondary infection by unnecessary dressings and (e) immobilization in correct position during the entire period of healing.

It is necessary in considering the method that I propose to consider it and to employ it as a whole. It is not sufficient to

[1] "In four cases last year Dr. Dandy, our resident surgeon, irrigated for from twenty-five to thirty days with the Dakin solution according to the Carrel method, the properly prepared involucral cavities, and then, the microorganisms having been reduced for six or more days to about 1 in 10 fields (the counts were made by Dr. Lawrence), the soft parts were trimmed and the wounds closed. For about six weeks in one case, eight weeks in two cases, and three weeks in a fourth, the wounds remained closed and without evidence of revivement of the bacteria. Then the tissues became slightly inflammed and the wounds opened." (Halstead, W. S., in Keen's Treatment of War Wounds. Ed. 2. Phila., W. B. Saunders Co., 1918, p. 255.)

[2] "In spite of its immense value, four valid objections to the Carrel-Dakin method are evident:

1. The irritation of the skin, an irritation which sometimes is very painful and may persist for a long time. To minimize this it is essential not only to protect the skin by yellow vaselin but that minute care also be taken to insure the exact strength of the solution. Below 0.40 per cent the germicidal action is too feeble. Above 0.50 per cent the solution is too irritating. This means that the solution must be most carefully made and tested and that fresh solutions must be constantly prepared (cf. p. 88).

2. The solutions, when in contact with the wound exudates, lose their chlorin in an hour or even less time and become inert. Hence the need of a new supply of the fluid every two hours. This constant care, day and night, the care not to use too much or too little, the expense of so much solution, apparatus, and dressing, etc., make the method time-consuming and costly. Above all, it requires a large staff of doctors and nurses.

3. In order to obtain the maximum germicidal effect of weak hypochlorite solutions, it is necessary to keep them in constant contact with all surfaces of the wound. This means that dependent, the most efficient, drainage must be avoided.

4. It is impossible to keep up the treatment during transit for any distance. The dichloramin-T paste (p. 93), while much less desirable at this stage, can be substituted, as it usually requires only one daily dressing. (Keen, W. W. The Treatment of War Wounds. Ed. 2. Phila., W. B. Saunders Co., 1918.)

FIG. 1.

commend or to condemn any feature by itself. We shall admit, I think, that adequate drainage, protection against secondary infection and immobilization are good but a careful combination of all of these is necessary to secure regularly the results that I have described.

It is quite impossible to arrive at conclusions regarding the "rest method" for wounds without a considerable clinical observation or experience with exactly the methods I have described. The difference in the appearance and general condition of the patient is so striking that it must be seen to be appreciated. It seems necessary to demonstrate personally also to each surgeon that the presence of a certain amount of purulent discharge in and about the wound for a few days or even a few weeks does no harm.

The important and essential features of treatment, the protection of the wound and the part against infection, irritation by chemicals, irritative motion, etc., are the things that are necessary for wound healing, for protection against septicemia and metastatic infection and for recovery without deformity and disability.

In a few words it seems to me that what we have not done in the treatment of infected wounds and what we must do is to perfect our methods for the exclusion of infection and to provide the most favorable conditions for healing in correct position. This is necessary not only for recovery without deformity and disability but because injured and diseased parts in correct position and at rest are favored as to recovery by relief of muscle spasm, pain, shock, etc. and by the advantage given to the circulation and other natural forces of repair.

It is desired to add that preceding and following the reading of this paper typical and successful cases treated by this method were presented and described by Dr. Leo Mayer, Dr. S. Kleinberg, Dr. E. Weigel and Dr. Fred H. Albee of New York. Acknowledgement must be made also of successful treatment of several hundred such cases by Dr. F. J. Gaenslen of Milwaukee, Dr. Ellis Jones of Los Angeles, Dr. Arthur Steindler of Iowa City, Dr. Melvin S. Henderson of Rochester, Dr. Emil Geist of Minneapolis, Dr. Willis Campbell of Memphis, Dr. H. B. Thomas of Chicago, Dr. W. R. Laird of Montgomery, West Virginia, Dr. M. C. Harding of San Diego, Dr. Archa Wilcox of Minneapolis and others.

Further reports of cases treated by this method are requested.

The following is submitted as an illustrative case:

H. F. F., male, aged forty-one, was thrown from a wagon and caught between the wagon and a tree when a team of horses became unmanageable.

A physician was called and found a compound comminuted fracture at the lower end of the left femur. The patient was brought at once forty miles to the hospital and I saw him on the operating table. No roentgenograms were taken as the damaged parts were in full view on account of the compound injury.

Traction was applied immediately to both

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

feet in a manner previously described. Full length of the injured limb having been obtained and the knee having been supported by overhead slings on the traction table, the wound was cleaned up as carefully as possible. Some damaged tissue and foreign material were removed. Attached bone fragments were permitted to remain. The popliteal space was widely exposed, all the vessels being visible as well as palpable. There was no damage to any of the principal vessels or nerves.

Full length and exact position of the femur fragments as to rotation having been obtained on the traction table, the wound was wiped out with tincture of iodin and alcohol and then packed gently open with vaselin gauze. The entire wound area was covered over with vaselin gauze and a dry sterile pad. Ice tongs were inserted in the condyles of the femur as shown in Figure 1. A double plaster of Paris spica was put on with the ice-tongs imbedded in the cast.

From this time forward for six weeks nothing was done. At the end of that time a window was made in the cast, the ice tongs were removed and a new dressing put on. The wound was almost healed. A second dressing was done four weeks later, ten weeks from the time of the injury. At this time the cast was removed and good consolidation of the fragments had taken place. A single spica was applied. The single spica was left on until June 1, at which time the cast was removed and a ring caliper knee splint applied (Fig. 4).

The roentgenograms shown in Figures 2 and 3 were taken July 7, approximately four months after injury. Sound healing of the wound had continued and there was firm union with full length in good position. Knee joint motion was begun for the first time. It is to be noted that there were no postoperative antiseptic dressings. In ten weeks only two dressings had been done.

On October 4 the patient was asked to come to the office for the photographs shown in Figures 4, 5 and 6. Figure 4 shows the patient in the caliper splint. Figure 5 shows full weight bearing on the injured limb without additional support. Figure 6 shows the amount of knee motion, seven months from the time of injury.

This is the routine method in our cases of bone and joint infection. Both the operation and the after care are simplified to the greatest possible degree and the results both in our hands and in the hands of others who are applying the method have been almost without exception exactly as they have been in this case.

[Discussion of Dr. Orr's paper will be found on pp. 475, 476, 480–485.]

FOUR CASES OF OSTEOMYELITIS*

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CASE I. Rose B., eight years old, has had osteomyelitis of the right big toe for about a year. She had an operation soon after the onset of the osteomyelitis but the wound is not healed and she has had a persistent sinus, swelling of the toe and disability.

Our examination showed extensive involvement of the proximal phalanx of right big toe. On April 12, 1927, an operation was performed. All of the diseased tissue was removed, the wound was packed with vaseline gauze and a splint applied. The splint was not removed for a number of weeks at which time it was found that the cavity was filled with granulation tissue and there was no further active infection. The wound healed rapidly and has remained healed.

Roentgenograms show satisfactory regeneration of bone.

CASE II. Milton G., three years old, was brought to the Hospital for Ruptured and Crippled because of swelling of the right ankle and leg. His trouble started three weeks previously, since which time he had had pain in the right ankle, swelling and tenderness of the lower part of the leg and persistent fever.

Roentgenograms showed extensive destruction of the lower extremity of the tibia, the disease invading the ankle joint. An operation was performed on March 21, 1927. The abscessed cavity was exposed, the diseased bone was removed, the cavity was packed with vaseline gauze and a plaster of Paris bandage was applied from the toes to the knee. The bandage was removed three weeks later when it was found that the cavity was filled with granulation tissue which looked healthy. The surface healed rapidly and has remained healed since then.

A recent examination showed that the boy walks without a limp, the wound remains healed and he has no symptoms referable to the affected member.

CASE III. William, S., fifty-two years old, was seen first on April 29, 1927. He had osteomyelitis of the lower half of the left leg. One and a half years ago he sustained a compound fracture of the left leg. Osteomyelitis developed. He has had several operations, but they have been unsuccessful. The symptoms have persisted and several sinuses remained unhealed.

On May 3, 1927, an operation was performed. All of the diseased tissue was removed. The wound was packed with vaseline gauze and left widely open. A plaster of Paris bandage was applied. The first dressing was done three weeks after the operation, and subsequent dressings have been done at very infrequent intervals. The wound has been healed completely since August, 1927, since which time the patient has had no symptoms and walks about liberally.

CASE IV. Herman F., thirty-two years old, had an osteomyelitis of the right sacroiliac area four years ago. He was operated upon, the wound healed after innumerable dressings, but he has had several relapses since.

On May 20, 1927, an operation was performed. A large wound was made. The diseased tissue was thoroughly curetted and removed. The wound was packed with vaseline gauze and a plaster of Paris spica bandage was applied. The original dressing was left on for four weeks. Since then he has had very few dressings. The wound was healed completely by October 1, 1927, and he has had no symptoms referable to his back since then.

[Editor's note: Dr. Kleinberg's case reports are presented to illustrate further the Orr method of treatment.]

THE ORR METHOD IN THE TREATMENT OF
CHRONIC OSTEOMYELITIS[*]

A CRITIQUE

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NEW YORK

THE Orr method has attracted much attention and it well deserves earnest consideration and discussion. In criticizing it, which I mean to do, it is only fair to say at the outset that I have not used it. It does not appeal to me. In considering the method as a whole, one must discuss its essential components. As presented by Dr. Orr tonight, and in his publications concerning the treatment of chronic osteomyelitis, these essential components are: (1) primary extensive osteotomy; (2) avoidance of antiseptics and chemical irritants in treatment of the wound; (3) extensive and prolonged immobilization of the extremity in plaster of Paris, and (4) long delay (several weeks) before changing the first dressing.

1. Dr. Orr advocates as the routine treatment in chronic osteomyelitis a primary operation consisting in extensive chiselling away of bone structure and the preparation of a boat-shaped cavity (saucerization) to be made contiguous with the wound margins by being packed wide open with vaselined gauze. He advocates doing this without waiting for the formation of sequestrum or involucrum! This part of the Orr method is, of course, not new; indeed, it is quite old. It was, and to a large extent still is, the accepted surgical practice. It is what I as an intern was taught to do thirty years ago. My maturer observations and my experiences in handling chronic osteomyelitis lead me to assert that as a routine procedure it is wrong.

When there is suppuration in chronic osteomyelitis one should provide, if need be, adequate drainage through the soft parts, but in my judgment if there is no actual sequestrum, he should delay further procedure until it has developed. To chisel away more or less necrotic bone before there is a complete sequestration is not a good practice. It is an operation in which in the nature of things one does too much or too little; it involves a more extensive operation than may be needed, and a more prolonged confinement to bed.

For some years I have been preaching[1] for chronic osteomyelitis not only that one should whenever possible delay attack upon the bone itself until a sequestrum has fully formed, but also that one should then content himself for the time being at least with the simple removal of the sequestrum or sequestra. Very often, indeed, *in spite of overhanging bone*, this will be all that is needed to effect not only cessation of suppuration but also definitive healing. I have seen it happen again and again. Let me cite but two cases by way of illustration:

In June, 1926 there was admitted to my service at the Hospital for Joint Diseases a girl twelve years old who had been operated on some months before for acute osteomyelitis of the humerus and who had three moderately discharging sinuses leading to the upper half of the shaft of the bone. Roentgenograms showed about two-thirds of the length of the diaphysis extensively porous, necrotic, with incompletely formed sequestra, and with only beginning involucrum formation (Fig. 1). If a radical operation had then been

[1] Attenuated bone infections. Considerations in the treatment of osteomyelitis. *J. A. M. A.*, 1925, lxxxv, 1782.

[*] Discussion at meeting of Section of Orthopedic Surgery, New York Academy of Medicine, November 18, 1927.

performed, removing all the diseased bone, most of the length of the humerus would have been resected, and in the almost complete absence of involucrum to bridge this defect, the arm would have collapsed. I discharged the child from the hospital under observation, and had her readmitted five months later (November, 1926), at

An incision was made through each of these, the cloacae in the bone were enlarged only sufficiently to remove the sequestra by morcellation, and a small gauze wick was inserted into each cavity for drainage. These were removed in a few days. The wounds closed over rapidly and completely and have remained soundly healed ever

FIG. 1.   FIG. 2.   FIG. 3.

FIG. 1. M. D. May 26, 1926. Extensive necrosis involving two-thirds of the shaft of the humerus with only slight involucrum formation.

FIG. 2. M. D. Six months later (November 13, 1926). A very solid supporting involucrum has formed and there are now three sequestra lying in three discrete cavities.

FIG. 3. M. D. One year after Figure 2 (November 19, 1927). The humerus now shows a fairly normal shaft of healthy bone with no cavity and no area of necrosis. No operation for the chronic osteomyelitis was performed in this case except the simple removal of the three sequestra shown in Figure 2.

which time roentgenograms showed that there was a well-formed supporting involucrum and that the process of necrosis had resolved into three slender sequestra each about two inches long, lying in three separate cavities communicating, respectively, with the three sinuses (Fig. 2).

since (now one year). Roentgenograms today show the humerus as a solid shaft of healthy bone, and at present well healed, *with no cavities* (Fig. 3).

A boy six years old was admitted to my service last July with an osteomyelitis of the tibia of two months standing. A

suppurating sinus in the shin lead into a large cavity in the upper third of the shaft, containing a good-sized sequestrum, and discharging through a comparatively small opening in the bone. This was enlarged sufficiently to extract the sequestrum. The cavity was drained with gauze only until the discharge was serous.

that sound healing cannot take place over a "dead space" in the bone, that overhanging bone must be removed, and that healing must take place from the bottom. That belief was also opposed as an argument when I began my treatment of chronic bone abscesses by simple evacuation through a small drill hole. Yet I have

FIG. 4. J. L. August 17, 1927. One month after simple removal of sequestrum from the cavity in the upper third of the tibia.
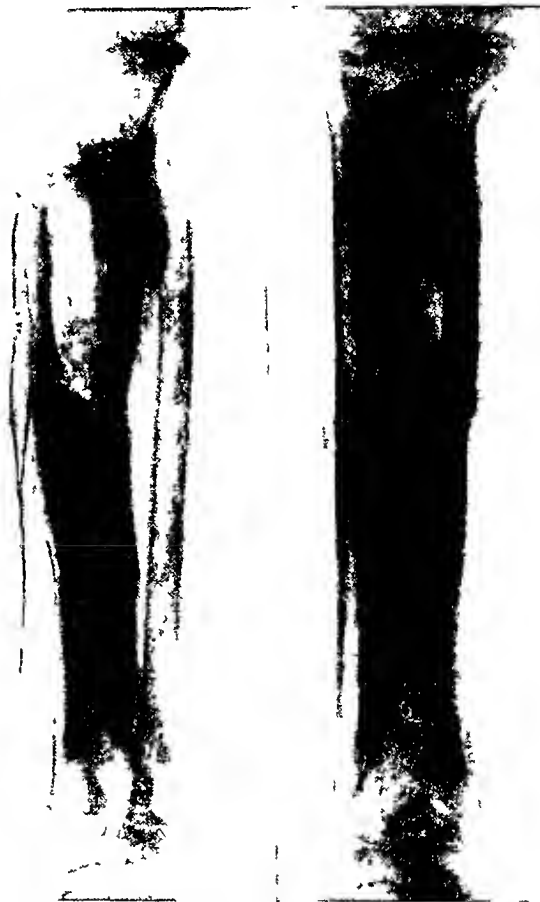
FIG. 5. J. L. September 2, 1927. About seven weeks after simple sequestrectomy. Note that the cavity is smaller.

Then the drain was discarded and the skin was allowed to heal over the cavity. It has remained solidly healed[1] and roentgenograms have showed progressive diminution in the size of the cavity (Figs. 4, 5, 6).

You will note that the operations in these, as in most such cases, are comparatively minor and involve little or no confinement to bed. I appreciate that they are contrary to the widely accepted belief

[1] Still well healed in February, 1928.

shown again and again that such chronic abscesses are usually sterile, or contain attenuated organisms, and that simple drill drainage not only promptly relieves pain but also is followed by definitive healing even though the bone cavity, small or large, cortical or medullary, remains indefinitely.

I hope I will not be understood as believing that saucerization is never needed to effect a cure. It is sometimes needed, of

course. In my opinion, however, such an operation should not be a primary procedure in chronic osteomyelitis but should be delayed until both its necessity and its extent are definitely demonstrated.

I hope, too, that I shall not be understood as counselling delay in acute osteomyelitis. In a recent article[1] Dr. Orr cited me as advocating delay and in a context implying that I referred to *acute* osteomyelitis.

2. Concerning the use of antiseptics I agree with Dr. Orr insofar that I regard them as of limited service in ridding a wound of organisms and in effecting healing. I am by no means ready, however, to cast them aside entirely, especially the proper use of Dakin's solution, which often helps to stimulate healthy granulations and is very useful in freeing a wound of adherent sloughs. There are, too, some wound infections, notably, contamination by Bacillus pyocyaneus, that demand antiseptics. I find that daily dusting with powdered boric acid is fairly specific for this contamination. I would ask Dr. Orr how he gets rid of it without antiseptics, and I would point out, too, that contamination with Bacillus pyocyaneus, as may well occur in chronic osteomyelitis, will produce a sorry mess and an unholy stench if confined for weeks in a plaster cast, as in the Orr method. Moreover, is Dr. Orr entirely consistent in railing against antiseptics and chemical tissue irritants, when he tells us that at the end of the operation he floods the wound with tincture of iodine and then with alcohol!

3. I fail to see the necessity or even the desirability of extensive and prolonged immobilization of the extremity in a plaster of Paris cast. I do not find that patients with chronic osteomyelitis suffer so much with muscle spasm after operation that such immobilization is necessary. I cannot see the need of immobilizing the knee and the hip after an operation for osteomyelitis in the neighborhood of the ankle—and in

[1] Orr, H. W. Treatment of osteomyelitis and other infected wounds. *Surg. Gynec. & Obst.*, 1927, xlv, 446.

small children Dr. Orr encases in plaster not only the hip on the affected side, but both hips. In addition to the other objections to prolonged fixation in a plaster cast that I shall mention, it may conceal and delay the discovery of the development of another focus of infection in the same or a neighboring bone.
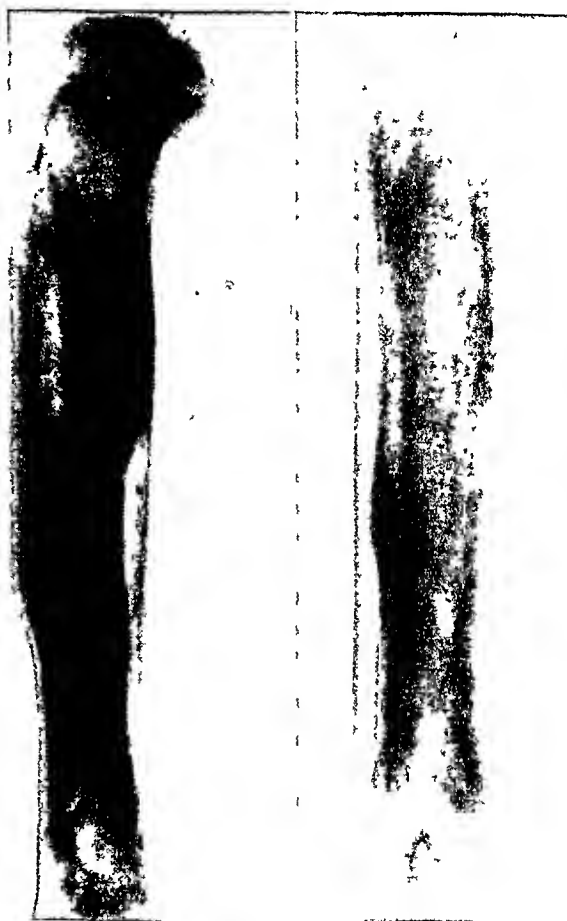
Fig. 6. J. L. October 17, 1927. Six and one-half weeks after Figure 5. The bone cavity is much smaller. No operation was done for the chronic osteomyelitis in this case except the removal of the sequestrum from the bone cavity over which the skin soon healed and has remained well healed. Note that the roentgenogram shows a small focus of bone absorption in the lower third of the tibia. Here a small abscess formed in January, 1928, and closed after simple incision

I am familiar with Dr. Orr's notions concerning the desirability of fixing the joints. In the A.E.F. he advocated it in the treatment of gunshot fractures when most of us were committed to joint mobili-

zation in traction-suspension apparatus. Dr. Orr believes that joint stiffness is due not to fixation but to infection. I am among the many who believe that prolonged immobilization produces muscle atrophy, bone atrophy and joint stiffness. Recovery from such stiffness is fairly rapid in children but in adults it often takes a long time, prolonging the period before they may resume their occupations.

In the treatment of fractures of the shaft of the femur, reduction and immediate immobilization in plaster of Paris is admissible in children and young adolescents when the fracture is transverse and satisfactory reduction is thus at once attained. I would also approve were an adult with transverse fracture of the femur so treated if an exceptional circumstance, as, for example, the need for immediate travel, made it desirable. Speaking generally, however, I am with those who object to the primary treatment of fracture of the adult femur shaft in a plaster cast, even if combined with skeletal traction as Dr. Orr has described, and who believe that a better result, functionally if not also anatomically, will be secured by the intelligently employed traction-supension method, without joint fixation and with active joint motion encouraged as early as is expedient.

4. I cannot agree with Dr. Orr that it is important to delay the first dressing for many weeks. After an extensive osteotomy with the wound packed wide open it is, indeed, very desirable to leave this packing in situ until the wound is fully lined with granulations. This, however, does not take many weeks. Removal of the packing (which is easy and painless if, as Orr recommends, the gauze is impregnated with vaseline) at the end of about a fortnight will show the cavity satisfactorily granulating; and thereafter, with ordinary surgical care, the wound is not apt to be secondarily infected by dressings at reasonable intervals. I cannot see what is gained by delaying this first dressing so long that the odor becomes an offense to the patient and to all about him. Dr. Orr has told me that by the time there is a bad odor he has sent the patient home in his plaster cast. But is that odor any more endurable in the home than in the hospital?

While I am frankly not favorably impressed with the "Orr method," and not in agreement with all the principles upon which it is based, I believe that it emphasizes some important practical teachings. Dr. Orr deserves commendation for insisting, first, that well-planned operations (in which, however, he is more radical than I) are far more important than antiseptics in effecting healing and cure; and, second, that it is desirable to delay dressings in order to obviate pain and reinfection.

DISCUSSION OF DR. ORR'S PAPER

DR. FREDERIC W. BANCROFT. I came here tonight very much in doubt in regard to Dr. Orr's method, as I have never used it. He brought out some factors, however, that are of great interest. The surgical principles which he uses during the operation are sound. He drains adequately without unnecessary trauma.

To compare any series of cases of osteomyelitis with any other series is difficult, on account of the various factors involved, that is, the age of the child, the virulence of the infecting organism, the resistance of the individual, and the bone involved. It is also very difficult to compare statistics in different hospitals in relation to the use of the Carrel-Dakin treatment. Crile's description of the Carrel-Dakin treatment I think is excellent. That is, it consists of the principles of the dog's lick. Anyone who has seen a dog constantly cleanse a wound with his tongue without inflicting any trauma will recognize this point. Frequently the Carrel-Dakin treatment is abused and much trauma is done at each dressing. If done with care, satisfactory results ensue.

Dr. Orr drains his case carefully and well and then puts the part absolutely at rest. That healing can and does occur with his method of treatment is adequately shown. If we assume that acute osteomyelitis starts as an embolus in one of the terminal branches

of the nutrient artery and that bone necrosis proceeds by retrograde thrombosis of this artery, then by Orr's primary operation of removing the lid and adequately draining the septic cavity without trauma, and without inflicting trauma in his later dressings, he has made a marked contribution. I should like to know whether the prolonged immobilization of the joints produces bone atrophy and joint stiffness, and whether his cases are able to regain their ordinary function as quickly as cases treated with Carrel-Dakinization where mobilization of joints occurs earlier. It has been my practice in osteomyelitis to remove the lid from the cavity if there is pus under tension, and to insert Carrel tubes so that the solution drains into the cavity. No packing or trauma is produced in the cavity, for if packing is inserted, then removed and re-packed daily, factors are introduced which tend to favor retrograde thrombosis and secondary infection.

The real treatment in osteomyelitis is the early recognition of the disease within twenty-four hours, and immediate operation. If this can be done, secondary sequestration will be greatly reduced and the period of disability shortened tremendously.

Dr. WALTON MARTIN. In his treatment of infected bones Dr. Orr has emphasized the value of immobilization, rest and protection from injury in contrast to the little worth of frequent flushing of wounds with antiseptics, especially when combined with disturbance of wound surfaces and edges. There are theoretical considerations deduced from experimental work and practical experience gained during the Great War which bear him out.

I should like to call attention to the experiments of Giani, made twenty-three years ago. He made fresh wounds in susceptible animals, then laid as gently as possible filter paper soaked in pure cultures of anthrax bacilli on the wound, two, six, eight, ten and fourteen hours after the wound was inflicted. The animals were protected from infection by the layer of round cells which rapidly accumulated beneath the wound surface and the protection was more marked the longer the interval after the wound was made. Most of the animals lived while controls died. If, however, he broke through the layer of cells by inadvertent roughness in his manipulation, and this was made evident by slight bleeding, the animals regularly died. In other words, secondary infection and reinfection can readily be caused by slight breaches in the walls of a granulating wound.

During the war it was generally recognized that if a heavily contaminated wound filled with foreign bodies and devitalized tissue had been converted into a slightly contaminated one lined by vital tissue by a surgical operation, the wound could often be closed by primary suture provided that the patient could be kept at rest. If, however, it was necessary to disturb the wound surface by transporting the patient, the delicate balance between resistance and infection was upset, the body cells were no longer able in many instances to destroy the remaining microorganisms and infection resulted. The rule was not to attempt primary suture unless rest of a week or ten days could be insured.

In regard to antiseptics, there are certain general principles which are important to keep in mind. First, that chemicals act by combining with the protein of bacteria; second, the antiseptic has a tendency to combine with other substances with which it comes in contact; third, it is rapidly used up in these combinations; fourth, the active cells on which the combating of infection is dependent are more delicate and more readily destroyed than the bacilli. All these relations were carefully studied and the results published in a monograph by Douglas, Fleming and Colebrook in 1920, reviewing the experience of the Great War. They seem to show equally good results when using salt solution instead of Dakin's solution. The painstaking technique of Carrel, with insistence on the avoidance of trauma and secondary infection, accomplished the results largely probably through the intermittent flushing of the wound and the lytic action of the Dakin's solution.

In general in the treatment of infection it seems to me well to keep in mind that the surgeon does not cure infection. He creates conditions which he has learned by experience aid the body cells to overcome successfully the invading microorganisms. When infection has become established purely surgical measures have little influence on the virulence or number of the infecting microparasites, but removing sequestra and foreign bodies, converting shut-in cavities in the tissues containing exudate under tension to wide open spaces with shelving sides, has a most extraordinary influence on localized pyogenic infection.

I do not believe that the odor caused by decomposition of the discharges set up by bacteria, probably saprophytic, has much influence on the course of infection. As a rule the unpleasant smell is repulsive to the patient and interferes with the appetite. When the dressings smell, even if there is no temperature, I believe it is an indication that they need to be changed.

I find myself in agreement with the general principles of Dr. Orr's treatment. There are, however, so many grades of pyogenic infection, such a variety of forms, that I should rather see a widespread knowledge of the underlying principles emphasized than a rigid standardization of treatment.

DR. FRED H. ALBEE. In reference to mobilization or immobilization, the latter is a moot question that hardly two men will discuss alike.

I have been a great enthusiast over the Carrel-Dakin treatment. I had extensive experience with it during the war and was with Dr. Carrel for a time at Compiègne.

My experience with the Orr method has been limited to four cases. I believe that in selected cases it has distinct advantages. One of my cases was a young woman of twenty-three with acute osteomyelitis who had been treated before I saw her by small multiple skin incisions without drainage of the canal, although there was involvement of the whole anterior part of the tibia for three fourths of its length. The woman had become very nervous and daily dressings had been done for seven weeks under an anesthetic. There was elevation of temperature to 102°.

The advantages of avoiding daily dressings under a general anesthetic were obvious, as the patient was becoming more nervous from former treatment. Therefore I decided to try the Orr treatment. This necessitated dressings every three to five weeks. The case progressed very well but the temperature rose to 103° after the application of the cast, coming down on the second day to 99°. The case was left on for five weeks. I went to Europe and the dressing remained on for the entire time that I was gone, the case being under the observation of my associates.

The Orr treatment eliminated the necessity for frequent anesthetization and the patient's nervousness decreased. I am sure that no one would argue for Carrel-Dakinization in a case like that. The result was most satisfactory.

As to immobilization, I think there has been much misapprehension about that. Immobilization does not produce permanent atrophy. Pain from lack of immobilization is more likely to do so, for pain causes continued spasm of the muscle, and this produces atrophy. Many times efficient immobilization, if proper physiotherapy is carried out afterward, will prevent permanent stiffening of the joint, rather than produce it.

DR. LEO MAYER. I think we should try to clinch the argument tonight in the discussion, considering there are many points on which we disagree. There are two or three questions I want to ask Dr. Orr. First, has Dr. Orr observed a parallel series of cases, with immobilization and without? I am not referring to fractures for they have to be immobilized in proper position. I am referring to cases of osteomyelitis in the central portion of the tibia. I cannot see why the plaster should have any particular effect. But I am going to try it in certain cases and compare it with some cases without. I think it is indicated in the neighborhood of some joint but not in the middle of the long bones.

The second question I want to ask Dr. Orr is, has he run a parallel series of cases, changing the superficial dressing when necessary but leaving the tampon in place? The odor is unpleasant; why not remove it if possible, leaving the vaseline gauze in place and preserving asepsis? Why object to cutting open the plaster? I do not see why we cannot remove the superficial dressing and leave the deep ones in place. I have seen cases where by a small incision and a small opening a long standing sinus was cured; I am therefore not convinced that saucerization is always necessary.

DR. ARMITAGE WHITMAN. Should we use this method of Dr. Orr's to the exclusion of all others? In individual patients one encounters individual pathological conditions, and the type of operation should be chosen according to its suitability to a given case. We may agree that the saucerization operation is ideal but we shall surely encounter cases in which its employment is impossible.

Another point, and a most important one: who dresses the wound after operation? When we first went abroad in 1917, I read with great interest Dr. Carrel's descriptions of large cavities with small outlets continually filled with Dakin's solution and healing from the bottom upward. When we got to France we

found it necessary to modify his treatment. The wound was laid wide open, packed from the bottom with gauze and Dakinized. When we did the dressings ourselves, healing under ideal conditions ensued. When the dressings were done by inexperienced hands the results were very different. We had an opportunity later to watch Pedro Chutro's method, and the same experience was repeated. I emphasize this historical fragment because the single method of treatment is a pit into which the very best are prone to fall.

Dr. Orr had a large and painful experience abroad. I can imagine the type of so-called Carrel-Dakin dressings that he saw, and the deplorable results, and can quite agree with him that most of the cases he embarked for transport would have arrived in this country in much better condition had he been allowed to apply his method of treatment and encase them in foolproof plaster bandages. Those conditions, however, were fortunately exceptional, and I am not prepared to apply the lessons that we learned from them in toto to civilian practise.

Dr. Elmer P. Weigel. I agree with Dr. Whitman that treatment of all these conditions cannot be standardized. There are different indications for treatment presenting themselves in different cases.

My only experience with the Orr method has been in chronic osteomyelitis. Two or three years ago I was skeptical about it but having been reassured by the men who have tried it, we have adapted the treatment in osteomyelitis cases. I have treated eight cases and in each one my experience has been entirely satisfactory. I was particularly impressed with the extreme comfort with which these patients were treated. It is possible at the end of two weeks to change the dressings without disturbing the packing. The patients are more comfortable than with the Carrel-Dakin treatment.

Dr. Abraham O. Wilensky. I have followed Dr. Orr's work carefully and think there are occasions where his method can be advantageously used and others where it can be just as advantageously not used. There is a marked difference between wounds of bone and wounds in the soft tissues, and a difference between acute and chronic osteomyelitis. Any wound will heal if there is no bacterial or mechanical impediment to its healing. Sometimes the elimination of these impediments will occur

naturally and sometimes it becomes necessary to help these natural processes by operative means. In acute osteomyelitis much should be left to nature and Dr. Orr's method or better still, a modification of it might be advantageously used.

Given a wound in which there are no impedimenta to healing, almost any form of dressing will result in healing. Dr. Orr's method is valuable in that it points out the advantages of allowing nature to work undisturbed, but it is unnecessary to go to the extremes that he does and to allow wounds to go undressed for the periods that he advises. In some, I do not want to say many, this apparent conservative attitude will defeat its own ends, and in many of the lesser wounds and infections the method is entirely unnecessary. This method is valuable if one mixes with it a certain amount of common sense.

In bone wounds one should leave as much as possible, and this means in many cases everything, to nature. Firstly, because one does not know the extent of the secondary effects of the original thrombophlebitis and, secondly, because any operative procedure produces much traumatic disturbance which many times increases the effects of the primary thrombophlebitis. In acute joint infections one should treat the factor which produced the joint infection, bone or other, and leave the joint itself to do as much as possible by the natural processes of repair.

Finally, I am sure that gentleness in handling tissues is the most important thing we can learn. In infections this becomes of dominating importance.

Dr. Orr. I should like to express my gratitude to all those who have taken part in the discussion. So much territory has been covered that I must first ask you to believe that I really have an answer for every question that has been asked but I shall not be able to give all these answers this evening. There are many important points, however, that have been raised in the discussion and I shall deal with these to the best of my ability.

Dr. Bancroft speaks of the variation in virulence of the bacteria attacking in these cases. It has been my observation that the apparent virulence of the organism is usually promptly modified by correct treatment. I mean by that, of course, that the organism becomes more virulent if the patient is not relieved by prompt drainage; also, if the

patient is drained and then re-infection developes a septicemia, he gives an appearance of virulence of infection which is really due to other causes.

Regarding the question as to bone atrophy, we do, of course, in some of these cases get extreme decalcification, but we all know that restoration of bone strength comes rapidly in a limb that is recovering. As soon as splints and braces can be left off and infection is healed the matter of bone atrophy takes care of itself in a short time.

My attitude toward the acute case may be expressed by what I have said regarding the relative importance of drainage and immobilization. If I were suffering myself from an acute osteomyelitis and had to choose between drainage alone and immobilization alone, I think I should choose immobilization for the reason that drainage will usually take care of itself in a short time. Drainage without immobilization renders the patient liable not only to rapid extension of infection, pain, irritation, etc., but to contracture deformity and extreme disability as well. Of course it is my belief that both drainage and immobilization are necessary.

Dr. Martin's remarks with reference to the protective wall of leucocytes that forms about a wound or inflammatory area where there is an acute infection are, of course, of great importance. Everything that I have said regarding the protection of the wound has been said with this point in mind. All of the methods of daily dressings are objectionable for the reason that they damage this wall. If we can preserve this protective wall and keep out additional infection as well, by non-irritating, non-absorbent dressings, we are giving the wound an opportunity to sterilize itself and to protect itself against invasion from the outside. My comments upon the work of Professor Chutro and his employment of the Carrel-Dakin method have been somewhat extreme because I wish to make my points with regard to protecting the wound and immobilization. One knows, of course, that the Carrel-Dakin technique in competent hands is a good method for cleaning up a wound and for preventing septicemia. On the other hand it causes an amount of disturbance to the damaged part and to the patient out of all proportion to the value of the antiseptic treatment.

Dr. Brickner's criticism that I am inconsistent in using any antiseptic in the wound is, perhaps, deserved. In employing tincture of iodin and alcohol following operation of these cases and at the time of my infrequent dressings, I am apparently violating the principles that the wound should not be disturbed and that antiseptics should not be applied directly to the surface. My excuse, however, is that these are used in an effort to exclude infection from the wound and not to deal with infection in the manner that is so commonly being employed when the effort is made to destroy infection in the wound day after day. This I believe to be impossible and injurious to the patient. Even if we ever do find the ideal antiseptic and may employ it to destroy infection in a wound such as we commonly have in osteomyelitis or in compound fracture, I think we shall still do well to employ it in the occasional manner that I describe and not as a daily dressing. If pus organisms and even gas bacilli can be excluded from the wound in this manner with the patient put in the best condition and position for restoration, his prospects for recovery are thereby improved. As to the actual length of time that must elapse between an operation and the first dressing or between subsequent dressings, that must, of course, be left to be decided according to the circumstances. I am not willing to say, however, that every surgeon or every doctor shall make that decision. If those of us who have had more experience and who have given special thought to this subject cannot outline a fairly definite program for the care of these patients by which others may be guided, then, after all, our special experience and special training are worth nothing.

No one appreciates more than I do that the method I have proposed is still imperfect in many respects. Those of you like Dr. Albee, Dr. Mayer, Dr. Whitman, Dr. Brickner and others, who are willing to think it over and test it out in your hospitals and laboratories, can, I am sure, assist us in arriving at methods and details of technique that will greatly improve our results in this difficult class of cases.

Dr. Brickner's suggestion about waiting for sequestrum formation and for the protective involucrum before opening up the chronic cases has proved to be valuable in many cases. One point that I am trying to make is that in the acute case or even in the early chronic case extensive sequestration can be avoided by more thorough drainage. The extensive death

of bone that leads to the formation of large sequestra often is due to the spread of an original infection which has not been adequately drained. If we can do any early drainage, it should be done as soon as we see the patient, whether this is the second day of his attack or the tenth. In this way extensive bone necrosis can usually be prevented and the patient's chance for recovery without great damage improved.

Drill holes as advocated by Starr are inadequate in many cases; in fact we consider that more extensive drainage is necessary in whatever stage most of these patients come to us for operation. Dr. Brickner's method of lifting out a sequestrum and closing the cavity is open to the objection that in some cases pockets of infection may be covered up and lead to recurrence or new trouble. Some of these certainly do heal at the time but we have all seen cases that have been treated by this manner or by skin flap, muscle flaps, fat flaps, etc., who have further bone destruction and sequestration and who require second, third and perhaps other operations.

As to the stiffness of the neighboring joints, that is a point that always comes up for discussion. My point is that such stiffness is caused not by immobilization but by the extension of infection into the joints and into the structures about the joints. If an infected area is adequately drained and if the extension of infection is thus prevented, it does not matter how long the cast is left on, the amount of stiffness will be only as much as is caused by inflammatory adhesions, bony or otherwise.

I must express my appreciation to Dr. Albee, Dr. Mayer, Dr. Kleinberg and Dr. Weigel for having presented their interesting patients and for their discussions. It is perfectly obvious, of course, that these gentlemen are dealing with these patients from the standpoint of fundamental principles and that is all that is necessary. If Dr. Mayer can treat his patients without prolonged immobilization and can prove that it is not necessary, I shall be glad to modify my technique accordingly. At the same time Dr. Mayer is correct in saying that I do not trust many surgeons to do frequent dressings. I feel sure they will get secondary infections if they attempt it. I have a natural feeling that my technique is as good as that of others and I know I cannot do this sort of thing without reinfecting wounds, usually very shortly. I have certainly arrived at the conclusion that exclusion of infection is simpler and easier and safer than to attempt to combat infection by frequent dressings and chemical antiseptics.

HYDATID CYST OF THE LUNGS

EXAMINED DURING THE LAST TWENTY YEARS, IDENTIFIED BY EITHER OPERATION OR AUTOPSY

CARLOS HEUSER, M.D.

BUENOS AIRES, ARGENTINA

THE tumors of the lungs which have come under my observation in the years of my practice of roentgenography amount to over a hundred cases, all of which had been operated upon either by myself or by colleagues who also had examined the cases.

In 1903 I examined my first case of hydatid cyst tumor in the lungs in association with Dr. Caride of Buenos Aires. The history follows:

CASE I. E. F., male, twenty-eight years old, had complained for the last six months previous of a bad cough accompanied by blood expectoration, etc. From all the symptoms the case was diagnosed as phthisis and treated accordingly. He had no temperature until the fourth day of our observation, when it was 38.4° to 38.6°c. in the afternoon.

Dr. Podesta, also a Buenos Aires physician, examined the patient and had him sent to Dr. Carides' Sanatorium. While there we examined him by roentgenogram in which an enormous cyst tumor was plainly shown. I would like to mention that this was the first roentgenogram of hydatid cyst of the lungs made in Buenos Aires. The diagnosis of hydatid cyst was made because we found it had a definite round form free around the borders.

There was no other symptom except the reverberation on the side. In August, 1903, the ninth rib was removed, the tumor was punctured, opened and dried. It proved to be a cyst tumor with many small subtumors.

From this cavity the membrane was extracted and was sewn to one side of the wall of the pleura. After about six months suppuration, it started healing and the cavity gradually filled out.

We have observed that tumors of the lungs develop as well on the right as on the left side, but we have also noticed that the left side is more often infected. The latter position is always a more serious one in the operative intervention, the reason being that patients die of gangrene of the lungs within six to eight days after the operation, unless the method of pneumothorax of Dr. Arce of Buenos Aires is employed. We lost two cases by gangrene before employing the method of the pneumothorax.

A diagnosis of tumor, hydatid cyst of the lungs, is not always an easy matter for, although the shade of the cyst tumor of the lungs is lighter than carcinoma or sarcoma of the lungs, it is nevertheless often mistaken for the latter, as I will show.

When the hydatid cyst tumor of the lungs is filled with a clear liquid it looks more transparent in the roentgenogram as the ribs can be seen through it; this is not the case if it is a suppurating tumor or a tumor with many subtumors.

I quote from my records some of the more interesting cases of hydatid cyst of the lungs on which I have operated.

CASE II. A working man, twenty-nine years old, living in the country, complained of pains in the right side, with a cough but without expectoration. We had him under observation for two weeks in the sanatorium and the clinical diagnosis was pleurisy. We made also a roentgenogram examination and found a dark shade in the back, the same extending on the right side of the lung up to the fifth rib. The diagnosis was that of hydatid cyst tumors in the lung.

Operation was decided upon. Two ribs were resected and after the puncture a crystal liquid was taken out and the membrane taken away. The cyst was very large with many subcysts.

When the cleaning was done and the field perfectly dry, a membrane was noticed

extending way down to the liver; when dried, this was found to be a cyst membrane, which was carefully taken away.

At the end of four weeks during which the fever had been persistent, the size of the liver had increased. Another operation was decided upon. The abdomen was opened in the mammilary line, and all precautions having been taken, the liver was punctured and pus taken out. A cyst membrane was then extracted and dried. The wound in the lungs (pleural region) was in communication with the liver cavity. At the end of seven months the patient was discharged cured.

CASE III. S. V., thirty-two years old, single' arrived from the country with temperature of 39°c. in the afternoon. She complained of spitting blood and what we determined was a small hydatid cyst.

At the clinical examination a dullness was noticed spreading over the whole cardiac region down to the fourth rib, and extending back to the vertebral column.

The diagnosis was open cyst, suppurating. An operation was decided upon. We proceeded to the resection of two ribs and the lungs were sewn to the pleural border.

While the operation on the lungs was going on, the cavity opened and a large quantity of pus poured forth with many small cysts. For four days there was a continuous cough. On the fifth day after the operation we proceeded to wash out the cavity with a sterilized solution of chinosol and to our great surprise the patient nearly died of asphyxia. That was because the cyst opened into the bronchus and water got into the lungs. Fortunately the patient recovered from this attack and after four months of treatment she was sent to the country still with the cavity open to be treated at her home.

Two months later, the patient came back complaining still of an enormous suppuration from the wound. An immediate roentgenogram examination was made. To our great surprise there were plainly shown three india rubber drainage tubes in the cavity.

It developed that during the after treatment in the country, the patient, while informing the doctor of the disappearance of the tubes, did not state what had become of them, so a new one was inserted each time and the old ones remained. In the roentgenogram the three tubes could be plainly seen.

The tubes were taken out during the following two months and the patient sent home cured.

CASE IV. A woman thirty-eight years old, who came from Dolores, a small town in Buenos Aires Province. For two years this woman complained of a cough with purulent expectoration sometimes combined with blood. She had been under treatment by local physicians but with no result.

At our clinical examination diagnosis was made of pulmonary tuberculosis, prompted because both sides were dull and patient had a temperature of 37.6°c. every evening. In the roentgenogram examination we observed a large dark shadow in the lung which we diagnosed as multiple hydatid cyst.

We decided on an operation. We located the cyst between the ninth and tenth intercostal space of the breast. We resected the ninth and tenth ribs, punctured the lungs in this space but without result, but when puncturing the sixth intercostal space in the breast we met with the cyst which was opened and all that was possible was taken out.

This proved to us that roentgenogram examination for cyst of the lungs should always be done by having the patient in a standing as well as in a lying position.

Eight days after the operation the high temperature of the patient had not subsided and under roentgenogram examination we discovered another cyst following the line of the omoplate. Before operating we made another puncture at that point, located the cyst and operated at once.

After this second intervention nothing new developed and the patient left in due time, cured.

CASE V. A letter carrier, twenty-nine years old, came to us complaining that he had been expectorating blood for some time. The clinical examination was absolutely without result as to symptoms, except that a few râles could be detected at the left side. In the roentgenogram examination we found a dark shadow covering the heart. Our diagnosis was then hydatid cyst.

Operation was decided upon. We proceeded to the resection of the fifth rib, punctured the intercostal space in several directions and a pneumothorax was produced which changed all conditions.

We placed the patient on the roentgen-ray table. The cyst could be plainly seen. We punctured at this place and removed it, but unfortunately this patient died twenty-four hours after the operation.

It was thus proved that when pneumothorax is produced during the operation it is hard to find a hydatid cyst, the reason being that when the lungs collapse the cyst changes its position.

CASE VI. A woman forty-eight years old, who came from the town of Balcarce, Buenos Aires Province. She complained of great pains in the right side of the lungs and of expectoration of much pus and secretion. She also had chills and high temperature and had been under treatment by a local physician who had diagnosed the case as purulent pleurisy.

After our clinical examination we found all the symptoms of pleurisy and on account of the high temperature and chills also came to the conclusion that it was a purulent pleurisy.

At the roentgenogram examination we saw a dark shadow covering the right lung completely and were unable to define precisely either the inferior or the superior parts of the lungs. According to the roentgenogram the diagram was purulent pleurisy.

We decided on operation. We resected two ribs to make an opening large enough to have a large and effective drainage. The lungs were harpooned and the pleura opened. An immense quantity of pus poured out, intermixed with a large quantity of small cysts. After six months of treatment the patient was sent home on the way to recovery.

After three months the patient returned again with the same symptoms of purulent pleurisy. The roentgenogram showed clearly proof of pneumothorax superior with a cyst on the inferior side.

We operated again, removed the cyst and the patient was discharged after four months as cured.

CASE VII. A girl, twenty-six years old, had been operated upon for hydatid cyst of the liver in May, 1909, by one of my colleagues.

She came under my observation six months after the operation, complaining of a considerable discharge of pus from a fistula which had formed at the place of operation. In November of the same year we inserted a catheter through the fistula, and made a roentgenogram.

We noticed on the side a round well-defined shadow which we diagnosed as hydatid cyst intercostal, situated between the liver and the axillary line.

We opened at the place indicated, removed the cyst and the patient left three months afterwards, cured.

CASE VIII. A man, forty years old, who came to us in January, 1912, complaining of a fatiguing cough with blood expectoration.

In the clinical examination a shadow with a rounded bottom was found on the right side. Our diagnosis pronounced it hydatid cyst of the lungs. The roentgenogram examination showed a dark shadow extending from the superior part to the middle of the lungs. As the shadow was rather dark we decided it to be a sarcoma of the lungs.

Operation was performed and the surgical intervention met with a hard mass, some of which was taken out for pathological examination. This proved to be actinomicosis. Three days afterwards the patient died and the autopsy conformed this diagnosis.

CASE IX. A man, fifty-two years old, came to our clinic with all the symptoms of a large aneurysm. Roentgenogram examination showed this to be aneurysm and also a large hydatid cyst.

We kept this patient under examination for six days and he complained continually of great oppression, difficulty in walking, fatigue and great pain in the chest. As not much could be done for him he was sent home.

Two days afterwards he had great vomiting spells, expectorating large amounts of small cysts and blood. He died soon after. At the autopsy we found a perforation of the large sack in the cavity of the cyst.

CASE X. A laborer, twenty-six years old, came to our clinic for examination. He complained of fatigue, cough and abundant expectoration. In the examination of the latter there was found Bacillus Koch.

At the clinical examination there were all the symptoms of foci of pulmonary tuberculosis. At roentgenogram examination we found in the left lung also all the symptoms of tuberculosis and also a well defined hydatid cyst.

We operated for the latter; the cyst was drained, cleaned and dried and after six months

the patient was discharged as cured. This occurred in 1916, seven years ago and I am glad to state that this case is today perfectly well, as I have been able to keep him under observation from time to time.

Case xi.　We found a round mass covering the whole superior part of the right lung, which we classified at the time as cancer of the lungs. Some months after this case had come under our observation, he died. In the autopsy it was found that he had cancer of the stomach *as well as* of the lungs.

Case xii.　The roentgenogram showed two shadows on the left lung of the patient. In this case we employed the artificial pneumothorax following the procedure of Professor Arce of Buenos Aires University, injecting at the first time 150 c.c. and three days later 250 c.c. Three days after the second injection we operated, emptied and dried the cyst. Three months after this operation another intervention was required and another cyst was taken out in the same position as the first one, but situated a little deeper. Two years afterwards the patient returned complaining of great pains at the seat of the operation. Roentgenogram showed pleurisy adhesions and pneumothorax superior. The patient is still under treatment.

Case xiii.　A young man about twenty-two years old. He complained of severe pains on the side of the right lung.

The clinical examination showed a large shadow in the posterior part following the line of the omoplate. The case was diagnosed as pleurisy. The roentgenogram examination proved it to be a cyst on the inferior surface of the lung.

At the operation we found the diaphragm pushed upward. We cut the same, punctured the cyst and took out a cyst membrane on the superior part of the liver. After four months the patient was discharged as cured.

Case xiv.　A woman, thirty-five years old.

In the clinical examination we found an enlargement of the liver. The roentgenogram examination proved it to be cyst of the liver on the anterior surface.

At the operation the two lower ribs were resected to make a better examination of the liver possible, but nothing was found. The

wound was closed but by sounding further up a supradiaphragmatic cyst was found. This was operated upon and patient left after four months, cured.

Case xv.　A woman, thirty years old. She complained of fatigue, cough and bloody expectoration.

In the clinical examination a supracardiac shadow spreading over the whole precordial region at the left side was observed. At the right side the heart was found by percussion to be enlarged. The phenomena of pericarditis with all the noises was evident at the clinical examination.

In the roentgenogram examination the shadow of a double cyst could be plainly seen, which could be better seen in the posterior than the anterior part of the patient.

In this case the pneumothorax was used. Four injections of 200 c.c. each time were made and we operated.

The fifth rib was resected, the cysts were punctured, the membrane taken away and as the liquid entered the pleural cavity another incision in the inferior part of the left lung was made according to the procedure of Dr. Arce. The patient left the clinic after six months, cured.

Case xvi.　A woman, forty-five years old when she came under our clinical observation. Sixteen years before we had seen her, in 1906, her inferior maxillary was operated upon by Dr. Solar of Buenos Aires. The previous diagnosis had been periostitis. But the operation showed that it was a hydatid cyst in the maxillary bone. Seven months after this operation she went home apparently cured.

In June, 1923, sixteen years after this operation she came to us with a very inflamed and swollen face. The examination showed the lower maxillary very much enlarged. In the roentgenogram examination we found two large hydatid cysts in the maxillary bone.

The patient was immediately operated upon, the cysts punctured and dried. During the operation it was found that the maxillary bone was partly destroyed and a small piece was taken out. The anatomical pathological examination proved it to be sarcoma. This was treated with deep roentgen-ray therapy.

One week after the deep roentgen-ray treatment a large roentgen-ray burn showed on the

tongue, gums and throat. The patient could not take any nourishment and died three months after the operation. In the autopsy we found besides the roentgen-ray burns in mouth and throat, sarcoma of the liver and intestine.

Experience has taught us the following:

1. The diagnosis of hydatid cyst of the lung is not an easy matter.

2. The cysts may occur on either side of the lungs.

3. Clinical examination is not sufficient to prevent the mistake of diagnosing hydatid cyst as pleurisy or as some other disease.

4. Lung hydatid cyst can be associated with other diseases of the lung.

5. The operation of pulmonary cyst is a very serious one, if the cyst is not adherent to the ribs.

6. When the cyst is not adherent the removal is more easily accomplished with a pneumothorax operation.

7. In the operation of a lung cyst and before the pleura is opened, it becomes necessary to harpoon the lungs and attach them to the sides of the rib. If not, the pneumothorax that will be produced will change the position of the cyst.

In presenting this brief paper, I have laid before you some of the results of my experience among another people and in a far-away country. I trust, however, that the results may be of general interest and may contribute to your success.

COLOSTOMY UNDER LOCAL ANESTHESIA

Charles J. Drueck, M.D., F.A.C.S.

CHICAGO

THE method of anesthesia for the performance of colostomies is an important one. The dread of a general anesthesia is almost universal, and moreover individuals suffering from chronic colonic disease are not, as a rule, ideal patients for abdominal surgery. They are usually debilitated, suffering from disturbed nutrition, their resistance is much reduced, they all suffer with chronic intestinal obstruction or perhaps acute obstruction, so that only the simplest technique is warranted. They are so very prone to complications resulting from anesthetic accidents when ether is employed, that when complete surgical narcosis is deemed necessary I much prefer the use of gas and oxygen combined with local anesthesia. Most of my colostomies are carried out with the use of local regional anesthesia produced by the infiltration of ½ per cent solution of butyn. If the abdomen is greatly distended, and it is apparent that the intestine will protrude immediately the abdomen is opened, general anesthesia is necessary.

As the operation under local anesthesia is more tedious than when performed under general narcosis, every little thing should be done to add a possible comfort to the patient. The table should be covered with a pad four to five inches thick. Most operating tables are insufficiently padded. Patients will complain of the table being very hard after a few moments, lying on the ordinary operating table. For this reason I have an extra blanket folded and placed under the regular table pad. This may explain many of our patients' complaints of backache following general anesthetics.

During the entire operation a most careful handling of the tissues is essential. Rough wiping of the wound, tearing of the tissues, or unnecessary pulling with the retractors by a careless assistant, causes pain by dragging upon structures outside the anesthetized area, and this is often sufficient to cause restlessness and apprehension on the part of the patient which may end in complete demoralization. It is the neglect in observing these small and apparently trivial details that is responsible for many of the failures with local anesthesia and often results in undeserved condemnation of the method.

Methods of applying the local anesthetic comprise:

(1) Infiltration: the injection of the solution into the field of operation and well beyond the site of traumatism.

(2) Conduction: (a) topical; (b) deposit of the solution in the spinal canal or on a nerve trunk supplying the given area, regional anesthesia or nerve blocking.

The most simple method of producing local anesthesia is the infiltration or the edematization of the tissues in and about the site of operation. By the regional methods the nerves are blocked proximally to the site of operation and this is necessarily a more difficult procedure, demanding a thorough knowledge of the nerve supply to the operative field.

A combination of both methods is often advisable.

TECHNIQUE OF ANESTHESIA

Infiltration. It is not necessary to apply the anesthetizing agent directly to the tissues to be incised, but it may be applied entirely outside of the line of incision and thus secure good anesthesia which will be maintained until after the completion of the operation. The extent of the anesthesia depends upon the distention pressure on the nerve ends caused by the

amount of solution injected rather than the strength of the drug used. If a narrow strip of wheals is produced and the incision made through the centre of it, the solution escapes and the tension on the infiltration is relieved and when the skin closure is attempted, the needle enters unanesthetized skin in certain places causing great pain.

With the patient lying supine the initial injection is made at the left costal arch near the xiphoid process of the sternum and successive wheals are raised along the left costal margin to the tip of the eleventh rib, and from that point to the iliac crest.

The subdermal infiltration is carried downward the entire distance. Drops of the butyn solution raise the wheals as the needle is advanced. In this manner the needle is carried forward just under the skin.

The long needle (10 cm.) is best for this purpose. It is inserted within the margins of the anesthetic wheal first made and advanced, injecting the solutions as the needle is being pushed forward. In making injections over a wide subcutaneous area or in the deeper injections, the position of the needle is changed continually, injecting as the needle is pushed in different directions and to various depths. In making the deep injections it is necessary to puncture the skin in but a few places, as the long needle will cover a very large area when pushed in different directions.

A most important point in the technique, little emphasized, is to always inject with the needle advancing or during its withdrawal, but never with the point stationary, because of the danger of an intravenous dose. By keeping the needle moving the necessity for aspiration is eliminated.

The skin and superficial fat being anesthetized, the deeper fat may require some infiltration but usually not much. The needle is next inserted vertically until it is felt to pierce the fascia of the rectus muscle. Our patient evinces pain as this aponeurosis is reached and this sign also helps to recognize this fascia. Thirty c.c. of the butyn solution is deposited in the fascia along this line and then the needle is carried to the outer border of the rectus. This outer border where the sheaths of the external oblique and the rectus join is recognized by increased resistance to the needle. After this fascia has been well cared for the needle is carried through the rectus to the preperitoneal fat. This fat must be slowly and thoroughly infiltrated because it is a most sensitive structure. In patients of average weight, 100 c.c. of the 0.5 per cent solution may be necessary for an abdominal field block, and very large stout persons may require 150 c.c. of the anesthetic solution.

As the sigmoid comes into view it is grasped with rubber tipped forceps and its mesentery is infiltrated with 20 c.c. of anesthetic solution.

In making the abdominal section gentleness is most important. Farr[1] says "Even with a perfect anesthetization the pressure produced by the use of a dull scalpel will cause the patient discomfort. In order to meet this contingency the skin should be elevated between two pairs of towel clips while the incision is being made. A sharp scalpel is used and multiple gliding strokes are made rather than a forceful pressure of the blade through the tissues."

Local anesthesia with one-half to one per cent butyn is ideal for many cases and certainly reduces the anesthetic risk, although it is not in itself entirely devoid of danger. However, the case must be carefully chosen for local anesthesia, as pain is a question of tolerance which varies in different patients. What will be pain to one will not be complained of by another, and if the patient is highly nervous or temperamental, general anesthesia is to be preferred. The dangers of butyn are, first, injecting it directly into a vein, and second, the absorption of too large quantities. Idiosyncrasies to butyn are extremely rare.

[1] FARR, R. E. Practical Local Anesthesia and Its Surgical Technique. Phila., Lea and Febiger, 1923, p. 153.

DETORSION AND STABILIZATION OF THE FIFTH LUMBAR VERTEBRA IN

SCOLIOSIS*

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SCOLIOSIS still remains one of the most difficult problems in orthopedic surgery. Until recently the investigation of its treatment has dealt almost entirely with methods for its non-operative correction. It is only since the development of spinal stabilization that there has been any real incentive to study it from the operative point of view. In the work thus far reported, the apex of the primary curve has been the center of attack, stabilization being performed with the object of limiting deformity, usually only in the more severe cases. The only instance of operative interference in other portions of the curve which a search of recent literature has disclosed is that reported by Hibbs in which fusion of the fifth lumbar was performed in cases presenting excessive mobility of this vertebra. The operative procedure to be now presented attacks the lowest portion of the curve; it has for its object not only the limitation of deformity through stabilization of the fifth lumbar but also the establishment of an actual corrective force on the curve itself through the change in position of the vertebra which is applicable to scoliosis of any degree presenting the changes in the fifth lumbar to be described.

About four years ago while examining the roentgenogram of a case which had proven particularly resistant to the usual methods of correction, I was struck anew by the marked wedging of the fifth lumbar vertebra and its evident influence in aggravating the lumbar curve. It seemed clear that if the body could only be lifted on the depressed side, the curve would necessarily be greatly decreased. This idea of affecting the lumbar curve by tilting the base of support must be a very old one, since the elevation of the buttock on the side of the convexity in sitting and the lengthening of the leg in standing have long been well established details of treatment. As far as I knew, however, no one had determined the effect on the scoliosis of either conservative or operative correction of this apparent distortion of the fifth lumbar alone. Study of the problem from both these standpoints was accordingly undertaken.

In order to determine the effect on the scoliosis brought about by the conservative correction of this change in the lumbosacral region, it seemed best to disregard the dorsal deformity entirely. The body was accordingly immobilized in the following position: The patient was placed on the orthopedic table with the peroneal post in position. The pelvis was fixed by carrying the leg on the side of the convexity well over in the opposite direction and the trunk was then forced toward the same side as far as it would go with the spine moving in a purely lateral direction. A spica was now applied, the plaster being carried down on the leg as far as the ankle. It was found that the maximum amount of correction at the lumbosacral junction was obtained at the time of the application, no further gain at this point being noted after the patient was immobilized for a long period, nor through the application of successive casts. In one case this corrective spica was kept on for four months, the patient being recumbent, and was followed by a jacket, carried well down over the trochanter on the side of the

convexity to maintain the correction, which was worn for about six months, the patient being up and about. A reinforced corset was then used. At the end of the four months immobilization in the spica, the entire scoliosis seemed definitely diminished to ordinary inspection, but the only certain improvement that could be demonstrated roentgenographically was a moderate correction of the lumbar curve. When the patient was allowed up, this correction was maintained as long as the jacket was worn but when the reinforced corset was substituted, the deformity gradually returned to its original degree. It was evident, therefore, that some form of operative fixation was essential and that there was no necessity for a period of preliminary immobilization.

The following operation was devised to correct the apparent change in position of the fifth lumbar vertebra and to stabilize it in its new position: The fifth lumbar and upper part of the sacrum are exposed and the lateral articulations are freed of cartilage after the technique of the spinal fusion. The fifth lumbar is then lifted upward and backward on the side of the convexity by means of a heavy periosteal elevator or special instrument, using the sacrum as a fulcrum, and is held in this position by means of a specially shaped wedge of bone placed between the articular facets of the fifth lumbar and the sacrum. The remaining technique of spinal fusion is then carried out. Then the spica, which has been made previously, is applied to immobilize the spine and leg in the position already described. The patient is kept in this cast for the usual time required for fusion to take place. After the removal of the cast, a corset with side bars is worn during the day for three to six months and the spica applied at night. The usual physiotherapy is carried out.

The wedge of bone inserted between the facets is about one-half inch wide, one inch long and of sufficient thickness to maintain the maximum amount of separation and elevation.

Experience has shown it is not possible to use a wedge any thicker than one-fourth to three-eighth inch above and one-half to five-eighth inch below. In the beginning the wedges were made from the spinous process of the fourth lumbar but since this is composed of cancellous bone, it seems likely that under the very considerable force exerted a certain amount of crushing results before fusion takes place and thus the full effect of the operation is not secured. For this and other obvious reasons it is better to have wedges of different sizes previously prepared from beef bone. When the wedge is shaped as described, it is firmly gripped by the facets after the periosteal elevator is withdrawn and shows no tendency to slip. Should it not seem secure enough, however, it can be fastened securely by means of a small bone peg.

In considering the change in position of the vertebra produced by this unilateral separation of the facets, a study of the dried specimen demonstrates that the vertebra is elevated obliquely and rotated in a reverse direction to the curve. It can also be shown on the specimen that the separation of the facets blocks motion toward the side of the convexity. When a second wedge is inserted between the fourth and fifth lumbar, a greatly increased deflection toward the opposite side results. By this operation, therefore, not only is the lumbosacral joint, which in this affection seems to possess excessive mobility, stabilized but the vertebra is tilted and rotated in such a manner as to exert a definite corrective force on the curve.

The applicability of the operation is still to be established. It seems clear, however, that it should be considered only in those cases in which an apparent wedging of the fifth lumbar can be demonstrated by roentgenographic examination. Naturally the most favorable cases would appear to be those in which the lumbar curve is the primary one. The feasibility of performing the same operation at the base of the dorsal curve is being studied. It must be pointed

out that this procedure is a much less radical one than the fusion operation as now applied to scoliosis, in that since only one vertebral joint is stabilized, interference with the normal flexibility of the spine is relatively slight and hence the operation can probably be used in the less severe cases.

CASE REPORT[1]

The patient, Marie H., age nineteen, had been under treatment at various clinics since about her ninth year. She came under observation at the Orthopaedic Department of the *Allegheny General Hospital* in 1924, where the customary corrective jackets and exercises were used for two years. The scoliosis, which was of the right dorsal-left lumbar type, proved unusually resistant and it was not possible to obtain any permanent improvement in this time. Both the dorsal and lumbar

[1] Only the first case operated upon is being reported as in it alone has sufficient time elapsed since operation for a final estimation of the degree of improvement to be made. Up to the present time the operation has been performed in five other cases.

curves were very pronounced, particularly the latter. The right hip was unusually prominent and in order to reduce this prominence and secure as much correction in the lumbar curve as possible, an elevation of one and one-half inch on the left shoe was found necessary. The roentgenograms showed the apparent wedging of the fifth lumbar.

The operation of detorsion and fusion at the lumbosacral joint was performed on May 27, 1926. Recumbency was maintained in the corrective spica for four months, following which a corset was used for the day and the cast applied at night. Resumption of activity was carried out very gradually so that it was three months before the patient was going about in her usual manner, making the total period of protection ten months in all. Since that time all support has been discarded.

The roentgenograms taken immediately after operation and at frequent intervals since show that the change in the position obtained by the insertion of the wedge between the facets has been maintained with a consequent improvement in the lumbar curve. To ordinary inspection the symmetry of the trunk as a whole has been and still is steadily improving.

SCOLIOSIS TREATED BY FUSION

PRELIMINARY REPORT OF SOME OBSERVATIONS IN 348 CASES*

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THIS is a preliminary report of a study now in progress of structural lateral curvature cases treated by the Hibbs fusion operation at the New York Orthopaedic Hospital. It includes a total of 348 cases and covers a period from June, 1914 to December, 1926. Because the study is incomplete, no detailed statistical data will be given. Herewith follows a few observations.

Almost one half of the cases were caused by infantile paralysis. Nearly an equal number were of undetermined etiology. The few remaining cases were due to congenital conditions, rickets, and empyema.

The operation of the spine fusion is one of only moderate severity. In over one-half of the series the operative time was less than one and one-half hours. In only a few exceptions did the postoperative temperature go beyond 103°. The mortality rate was 1.1 per cent. Postoperative shock and pneumonia were the causes of death.

An area of natural fusion of the posterior elements was found at operation in a few cases. In no instance was this fusion adequate to prevent an increase of deformity.

Corrective gymnastics with or without jackets are of only temporary value in the treatment of the progressive scoliotics. In order to hold a correction and prevent the progress of a lateral curvature, stabilization is necessary. Our results show that this is accomplished by the spine fusion operation.

Many of the older patients were operated because of pain and fatigue in the poorly mobile curvature. All recovered from their symptoms except one, in whom the area of fusion was inadequate. Practically all in the series showed that their general health was improved, and that they have felt better since the operation. Excluding the few in whom the proper area was not adequately fused, all had an improvement in posture.

The area of fusion must be accurately selected. Fusion of a compensatory and not the primary curve resulted in an increase of the deformity. In a few cases difficulty was experienced in the selection of the primary curve. Incomplete roentgenographic records of the entire spine were not infrequently responsible for this error. A fusion of fifth lumbar and sacrum in only a very few cases stabilized a curvature of the lower spine.

The stabilized area must be adequate. In not a few the fusion did not extend low enough. This was especially noticed in the cases of paralytic origin and most marked in those with imbalanced abdominal musculature.

The correction gained by preoperative traction and turnbuckle jackets was not always maintained in the earlier cases operated. In these external support was not constant nor was it worn long enough after the operation. This error was corrected in the more recent cases by the use of a fixed jacket for six to twelve months after operation, depending on the amount of correction obtained.

Too short a period of follow-up resulted in an inconclusive estimate of our findings. A few of the younger cases of this series showed no great change in the degree of deformity until they reached the age of rapid growth.

* Read before Section of Orthopedic Surgery, New York Academy of Medicine, January 20, 1928.

A pseudoarthrosis or failure of fusion occurred in less than 3 per cent of the series. In these there was an increase of curvature at one place. One was due to a fracture, resulting from an injury about two years after operation.

In conclusion: spine fusion will prevent an increase of scoliosis if the area of fusion is adequate and accurately selected; in older patients relief from pain is obtained. This results in an improvement in posture, and general well being of the patient.

DISCUSSION OF DR. STEELE'S AND DR. RISSER'S PAPERS

Dr. Russel A. Hibbs. The problem of scoliosis is a very difficult one. We have had enough experience to justify the statement that the fusion operation is of great benefit in scoliosis. The errors which we have made in the past have been due in some instances to not fusing a longer area of the column, and in others in poor selection of the area of fusion. I am inclined to think that in most instances where the fused area has increased in deformity pseudoarthrosis is present; this has not been proven in all cases, however, by exploratory operation, though in some instances it has; the roentgen-ray pictures thus far do not give us conclusive evidence on this point.

Dr. Armitage Whitman. I think Dr. Steele has opened a valuable field for further exploration in that small group of cases in which he feels that an abnormality of the fifth lumbar vertebra is the cause of scoliosis. If there is an anatomical variation it classes the case under the head of congenital scoliosis and the logical thing to do is to stabilize the foundation as one would wish to square up the foundation of the leaning tower of Pisa.

I have been interested in operating upon ordinary cases of scoliosis in attempting by manual force, applied by a bone forceps to the exposed spinous process, to correct the rotation. I found this to be possible to a slight extent, but on removing the force the vertebrae at once slipped back to their original position—a fact which increased my scepticism as to the claims of osteopaths and chiropractors. I think Dr. Steele's bone block insertion is a logical thing to do and I shall be interested if he later reports this treatment to have been permanently successful.

Dr. Risser's paper leaves little to be said. I think a sharper line might be drawn between paralytic and idiopathic scoliosis. In the former class operation is logical and I heartily concur with what he said as to its effect upon the patient's general condition. Many cases of the

severest types of deformity have been passed over because the operative risk seemed so great, but I am convinced that the risk is justified and the operation indicated, for we know how few of these patients otherwise survive to an advanced age.

There is another thing that I wish to emphasize, that is, the improvement of posture in general. Too little attention has been given to the effect of posture in general. We see these patients coming to the clinic for gymnastic exercises in all sorts of slumped attitudes hold themselves correctly under direction for a few moments and go home again in the same slouching shamefaced way. I sometimes wish that I could have a talk with each parent separately and make him or her realize that it does not much matter what kind of a back one has provided one holds oneself erect. A crooked back held straight looks straighter than a straight back slumped. If you can get it into a patient's head that it is his back and his responsibility to hold himself straight, the degree of deformity of his spine is of comparatively little importance.

What Dr. Hibbs said about end results is true. You never know until a particular patient is dead whether or not a cure has been permanent. However, three of my girl patients have married and borne children without increase in their deformities; that is the surest test I know of.

Dr. Leo Mayer. I do not believe every case should be operated upon. I remember three cases of my own in which operation had been advised by other orthopedic surgeons; one was congenital, one paralytic and one idiopathic. The operation was refused, however, and nonoperative treatment has not only prevented the curves from becoming worse, but their appearances are absolutely normal and their posture proven to be of very high order. I am doing the operation of fusing the spine and doing more each year but there are cases that

can be kept straight by non-operative measures. They should be studied with extreme care to find out in which operative and in which non-operative treatment should be given and also, in the former, which type of operation should be done.

It is possible that in the cases where the deformity has increased at the site of operation, the area fused was too small. In our cases we are fusing more and more of the spine in two-stage operations, first the lumbar and then the dorsal spine, and the results seem to be very much better.

Another type of case demanding special attention is that where there is a marked list of the body to one side; in that type we have not succeeded in getting results in fusion. We have gotten better results with a prop, implanting a long bone graft from the crest of the ilium upward to the apex of the curve.

DR. REGINALD H. SAYRE. I remember that MacKenzie Forbes some years ago advocated very much the same thing and at that time I said I was sorry he had suggested it because I was afraid someone would be tempted to do it on account of his reputation. I myself some years ago had cases that I felt were just the ones to which this treatment might be applicable. There was marked wedging of the fifth lumbar vertebra and I felt theoretically that if I cut down on that it would be logical to expect improvement. I did not do the operation, however, because I doubted my ability to do so successfully. I shall look forward with interest to Dr. Steele's further report and hope that time will show that this bone chip he describes will be practically useful and that it will not work loose.

I agree with Dr. Hibbs that roentgenograms are sometimes very misleading. A condition shown in the upright disappears when the patient is in the recumbent position.

I was very much interested in Dr. Risser's statistics although I do not agree with the conclusions drawn from them. In most of the operations in lateral curvature the only result is an unsightly scar added to an already hideous deformity. In cases I have seen presented before this Society in person and by picture, I have been unable to discern where their posture or beauty has been improved, although I believe there are a few cases of paralysis which it is intelligent, practical and useful to operate. But with regard to the opinion that it should be

done in the vast number of cases with the idea of improving lateral curvature, I disagree. I agree with Dr. Whitman that if you can mentally impress these cases with the necessity of doing something for themselves they can vastly improve. If they can be induced to practice them every hour there are three or four exercises that will benefit them; they can be done at school, at home, at the shop, any place. Patients come to my clinic once a week and work faithfully and do that work at home, but they do these special exercises once an hour and get a great deal better.

I speak from inexperience from the operative standpoint but I feel this town has run mad with the idea of operative treatment in scoliosis. There is just as much fashion in medicine as there is in clothes and it might be well to await the outcome of these preliminary reports before wholesale operations in spinal curvature are adopted as suitable.

DR. LEON T. LEWALD. I was interested in Dr. Hibbs' point regarding the diagnosis of pseudoarthrosis and the failure of the roentgen ray to establish it. This, I think, could be done by taking enough stereoscopic exposures with the patient in various positions just as one distinguishes if there is non-union or fibrous union in fracture of the neck of the femur, by making a roentgenograph first in adduction and then in abduction and if necessary also in rotation in and rotation out. Similarly in determining the question of pseudoarthrosis of the fused spine, it would be advisable to make roentgenographic exposures in anteroposterior and especially direct lateral positions, first with the spine straight, then flexed as much as possible and then extended as far as possible. Then by very careful study and comparison of all the roentgenographs one ought to be in a position to express an opinion in regard to the presence or absence of a false joint.

DR. ARTHUR KRIDA. I should like to ask Dr. Risser a question concerning the selection of the site and extent of fusion. This recurred several times in his paper, but he told us little or nothing regarding the criteria he uses in this determination. There is another question that occurs to me; he spoke of correction in terms of certain angles and I should like him to enlarge on the method used in determining these angles. The term "wedge" has been used on several occasions in both papers in reference to the fifth lumbar vertebra. As I understand

it, this term should be restricted to those cases in which there is actual deformity of the body of the vertebra; in the cases under discussion it would appear that the deformity was in the nature of a tilt and the term "wedge" might be restricted to cases in which there is actual deformity of vertebral body.

It seemed to me that there was one statement in Dr. Risser's paper that contained potential dynamite and that was that methods of treatment of scoliosis by gymnastics were of no avail but were on the contrary harmful. I think this should be elaborated further, for we are all aware that scoliotics are habitually treated by gymnastics and that orthopedic surgeons so prescribe. If there is good evidence that this is harmful or at least of so little avail, the evidence and the conclusion to be drawn therefrom should be given the widest possible publicity.

DR. RISSER.   In answer to Dr. Krida's question about the selection of the area of fusion, I will say that it is one of our most difficult problems. Our policy has been to fuse from neutral vertebra to neutral vertebra. Recently, we have fused down beyond the neutral vertebra, especially in paralytics and particularly in those with imbalanced abdominal musculature.

The gymnasium work referred to has in mind correction of a progressive curvature and not gymnasium for general health or posture. Our experience is that the progressive scoliotic increases more rapidly with corrective gymnastics. Gymnasium treatment in these cases is wise only when the stretching and loosening up of the deformity is followed by fusion.   In the mature curvature cases, that is, those who have passed the age of rapid growth and whose curvature is well compensated, exercise for posture can be used to good advantage.

ANOMALIES OF THE APPENDIX

WITH REPORT OF A CASE OF CONGENITAL ABSENCE OF APPENDIX (AGENESIS) AND BICORNUATE UTERUS WITH ONE CERVIX

ADOLPH JACOBS, M.D.

NEW ORLEANS

AFTER reviewing the literature and considering the various commentaries made by the authors who have studied intensively the incidence of absence of the appendix, one would venture reluctantly to add another report of this unusual anomaly except in the face of undeniable evidence. Agreeing with Dailey to the extent that cases reported from the dissecting room or autopsy can be accepted with the least question of authenticity, still there are assuredly instances from the operating table, accompanied by evidence, identifying the condition without doubt.

CASE REPORT

A married woman, nineteen years of age, entered the Charity Hospital (Gynecological Service, 2A), New Orleans, Septmber 28, 1926. From the admitting office the tentative diagnosis of chronic pelvic inflammatory disease (pelvic abscess discharging large quantities of pus) was made. For one year she had had a foul discharge from the vagina. Regular menstruation had begun at fourteen years of age, of thirty day type, duration four days, moderate in amount, with only an occasional slight headache. She had been married three years with no pregnancies and no miscarriages. The patient affirms that there was no abdominal pain or previous operation. General physical examination showed nothing of importance. External genitals were puerile. Vaginal orifice was small. There was no discharge from the urethra or Bartholin glands, but a very foul odor was noticeable. Bimanual examination was very difficult but disclosed a very small cervix and on both adnexal sides an elongated, fixed mass, rather soft and tender, could be felt, seeming to lead into the posterior cul-de-sac. The contour of the body of the uterus could not be made out, owing to the tenseness of the abdominal muscles. Speculum disclosed a foul, greenish, thin pus, seeming to come from the cervix, which appeared very short. The vaginal mucous membrane was smooth with no cervical erosions. On closer examination a fold of mucosa was seen rising from the vaginal floor and lying transversely in front of the cervix, forming a blind pocket behind the cervix, from which also this foul discharge was coming. This fold lay so close to the posterior cervical lip that it was impossible to see the background of the pocket. By digital examination, however, a pit was felt which apparently led to the two pelvic masses noted in bimanual examination. It was concluded, without the history of abdominal pain or fever, that the two pelvic masses felt must be the source of the vaginal discharge through a fistulous opening in the vaginal wall. Proctoscopic investigation revealed nothing abnormal except the small cervix. The patient was kept under observation for three weeks, during which time the temperature was practically normal, with an occasional rise to 99 degrees and only on two days to 100–101 degrees. The pulse ranged between 84 and 96. Respiration 18–22. Leucocyte count was normal. Wassermann was negative. Urinalysis was negative. Culture made from the pus showed Bacillus coli, staphylococci, streptococci, micrococcus tetragenus and spore bearing bacilli.

Laparotomy was performed October 9, 1926. In exploring the pelvic cavity, two rudimentary, symmetrical, spindle-shaped uterine cornua were discovered, each measuring 5 or 6 cm. in length and about 3 cm. in the widest portion. These converged medially toward the cervix. To each of these rudimentary organs were attached a round ligament, tube and ovary, undeveloped. The round ligament was very slender and the ovaries very small, measuring about 2.5 by 1.5 cm. The tubes from

the uterine attachment to the fimbriae measured about 4.5 cm.; the width of the fimbrial extremity was about 1.5 cm. The peritoneum was smooth and glistening with no adhesions and no trace of any previous pathological condition. Further abdominal exploration disclosed no other abnormality except that investigation of the cecum showed it elongated, measuring approximately 10 cm. by 3 cm. in

"no evidence of organic pathology. A loop of sigmoid was coiled up, practically in the true pelvis, suggesting adhesions which cannot be eliminated on the film alone." On November 4, by gastrointestinal roentgenogram series, absence of appendix could not be determined.

It was decided that the foul discharge was due to the various secretions from the vagina and cervix, admixed with the various organisms

FIG. 1.

FIG. 2.
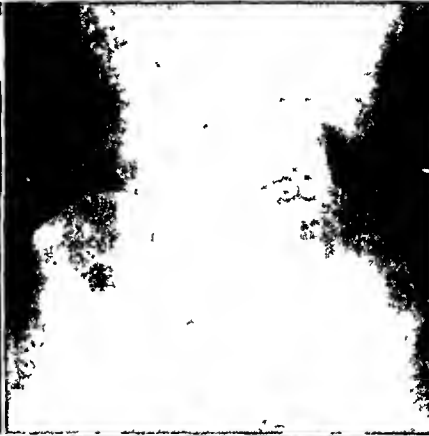
FIG. 3.

FIG. 4.

FIGS. 1, 2, 3 and 4. Gastrointestinal series, taken with the view of detecting other abnormality in intestinal tract.

width, freely movable, lacking the usual haustration and joining the ascending colon at a right angle. The muscular, longitudinal bands on the outer, lateral aspect joined approximately 3 cm. from the ileocecal junction. No trace of an appendix or mesoappendix was found, and in this region, also, were no adhesions or cicatrices, nor evidence of any inflammatory process. The abdomen was closed and the patient made an uneventful recovery from this unnecessary operation.

On November 2, 1926, a barium enema was given and the roentgenogram report showed

mentioned above, accumulating in the pocket behind the cervix which acted as a stagnant pool, and the lack of drainage was responsible for the existing condition. On January 21, 1927, a plastic operation was performed to do away with the pocket. An incision was made along the crest of the fold, separating the anterior from the posterior leaf, thus exposing the bulging rectum which was brushed downward and backward. The two leaves of the fold were excised to the level of the vaginal floor and the cut edges were sutured with continuous No. 1 chromic. A lipiodol injection was introduced

into the uterus, a plate of which is given herewith (Fig. 6).

After the second operation, the discharge still continued from the cervical canal, but the odor almost entirely disappeared. This disagreeable condition called for alleviation, hence, on February 11, 1927, under pericervical analgesia (0.5 per cent novocain) the cervix was well dilated and a sound introduced for

charge continued until the patient left on February 14, 1927. Three communications received on February 22, March 8 and on March 22, respectively, said that (1) while the discharge still continued, the odor had entirely disappeared; (2) that the discharge was practically nil and there was no odor; and (3) that she had menstruated as usual without any disturbance.
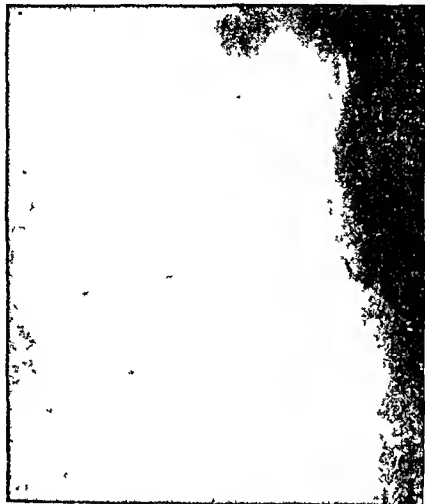
FIG. 5. Barium enema injection.
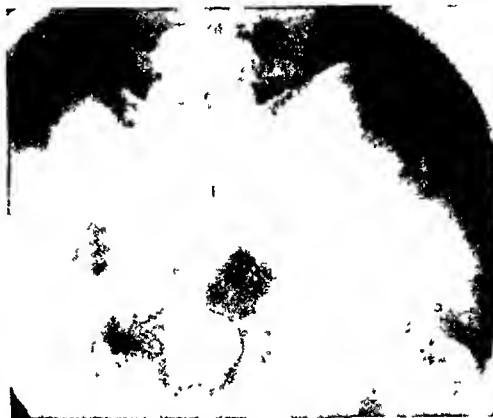
FIG. 6. Introduction of lipiodol into cervix. Note width of cervical canal with right cornua well represented. There was evidently an obstruction leading into the left cornua as only a thin streak of the lipiodol is shown. Bulky mass below represents a gauze pack saturated in lipiodol.
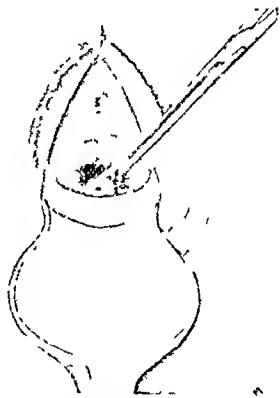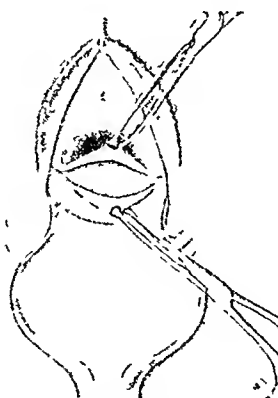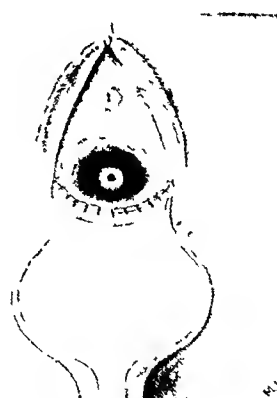
FIG. 7.   FIG. 8.   FIG. 9.

FIGS. 7, 8 and 9. Diagrammatic drawings of the abnormal vaginal fold and cervix, and technique of operation for correction.

about 2.5 cm., when it met with definite obstruction. The endocervix was red and inflamed. With a dull heat, the cervical canal was cauterized and another injection of lipiodol was introduced. Iodoform gauze dipped in lipiodol was packed in the cervix and left for 96 hours. The lipiodol admixed with the dis-

TRUE AGENESIS RARE

The absence of the cecal appendix (true agenesis) is very rare in man. Extremely few authentic cases are reported in the literature and the various texts on anatomy and surgery are conspicuously silent, or

merely mention it. Cunningham (1907) states: "Its absence is sometimes noted." Gray (1910): "It is doubtful that the appendix is sometimes absent." Note is made, however, that according to some authorities the appendix is absent once in 10,000 cases. In the 1924 edition of Gray, mention of the absence of the appendix is entirely omitted. Attention is called simply to the variation in the size of the appendix and cecum respectively. Piersol (1919): "Total absence of the appendix is extremely rare but it has been observed by ourselves and others." Kelly and Hurdon in their classical treatise on the vermiform appendix and its diseases (1905): "Cases of the complete absence of the appendix have been described but it is to be doubted that such observations have always been accurate. Nevertheless there are a few authentic cases of complete absence of the appendix."

HISTORY

Before the seventeenth century the cecal appendix was barely known. The anatomists of that time were not even decided as to the names of the first part of the large intestine. The term appendix was often given to the cecum and no anatomist of that epoch claimed priority to the description of the small cecal prolongation, considered by them of little importance.

The first case of appendiceal absence recorded was by Morgagni who observed this anomaly in man. It excited considerable comment because of speculation as to the probable use and physiological importance of the organ.

Let us pause in passing to mention various functions attributed to the cecal appendix by some authors. Even as late as 1885, Treves, in his series of lectures on the anatomy of the intestinal canal and the peritoneum, writes of the very slight physiological importance of the appendix, showing that in his mind some rôle, however minor, was attributed to it. Sartorius, in 1724, attributes to the appendix the bizarre rôle of a receptacle

for the lumbricoidis intestinalis. Sabatier, in 1791 said that "the appendix is always found filled with mucus and its use is to discharge into the cecum a fluid necessary to lubricate and mollify fecal matter and perhaps to stimulate peristalsis, so that it may contract with more force and thus empty itself with more ease of its fecal load." Sappey, in 1874, described the appendix as being a rudimentary organ without any important function; that, in some cases, it was found obliterated or in certain individuals excised without having caused any ill effects. Clado, in 1892, considering the appendix as a sort of glandular apparel annexed to the digestive tube, states that it is an organ with zymotic secretion and not one of absorption.

Certain authors, namely Lockwood and Rolleston and Kelynack, even doubt that the appendix is ever absent except as a result of disease or in consequence of a previous surgical operation. R. J. Berry, of Edinburgh, writing in the *Anatomische Anzeiger*, 1895, states: "Some authors have described total absence of the appendix. I do not, however, believe that the appendix is ever absent except as a result of a previous excision." Later the same author, as quoted by Gladstone in 1915, refers in 1907 to a specimen belonging to Fawcett: "The fact remains that it is the only case on record of congenital absence of the appendix vermiformis."

Dailey, considering the cases collected by Merling, estimates that the only authentic case is that of Meckel. This case was discovered in the course of an autopsy which permitted a minute dissection, and not a trace of pathology was discovered. Dailey does not grant authenticity except in those cases discovered during post mortem examinations.

In 1906, H. Heineck examined 3500 autopsy protocols at the Cook County Hospital with special reference to the appendix without finding a single case noting the absence of the organ.

As long as the appendix presents the usual dimensions, characteristic location

and appearance, it is easy to discover, but this is not so when it exists in an abnormal manner. According to Dailey, errors in reporting cases, as congenital absence, are due to various anatomical or pathological anomalies.

In order to have a clearer conception of the various states in which this vestigial organ is found, it would not be amiss to give a brief description of the development of the cecum and appendix.

DEVELOPMENT OF CECUM AND APPENDIX

Dr. Harold Cummings of the Department of Anatomy, Tulane University, New Orleans, says: "In the human embryo entering the second month of development the intestine is drawn toward the umbilical cord in the form of a simple u-shaped loop, the yolk-stalk arising from its apex. The divisions of the intestinal loop are designated cranial and caudal limbs, in description of their relative positions at this period. Jejunum and a part of the ileum are represented in the cranial limb, while the remainder of the ileum and the entire colon arise from the caudal limb. There is, as yet, no generalized increase in the diameter of the segment which is destined to form the colon. However, a cecal process appears on the caudal limb of the loop. It is a local bulging in the wall of the tube, situated on the free (non-mesenterial) border at a point considerably removed from the apex of the loop. The further history of the cecal process will be traced briefly, in accordance with the findings of Kelly and Hurdon.

"At about the seventh week the transverse diameter of the cecal process is no greater than that of the intestine generally; its length may be seven or eight times greater than the width. The elongated cecal process, originally of uniform diameter throughout, shows at eight weeks a beginning differentiation of the appendix and definitive cecum. There is a marked relative narrowing of its distal portion which constitutes the appendix. During the third month the cecum, or wider proximal portion of the cecal process, expands so as to exceed the caliber of the neighboring colon. Later fetal development is characterized by heightening of the size differences between appendix and cecum, although it is not until after birth that an abrupt demarcation between the two is acquired. The cecum attains its asymmetrical form in early postnatal life.

"Most embryos display a transitory distal bud of the cecal process, which apparently takes no part in the formation of the appendix. It is developed in varying degree in different embryos of corresponding age, and is limited in its appearance to the period prior to the separate definition of cecum and appendix.

"Arrests of development in the differentiation of the cecum and appendix may occur at any stage of the process, and the conformations which arise are correspondingly varied. The case of Robinson in which both cecum and appendix are wanting, is an extreme reduction presumably due to an arrest dating from the period of initial development of the normal embryonic cecal process. Less extreme grades of reduction occur as the result of later arrest. In the absence of the appendix the cecum may or may not undergo an independent evolution toward the normal adult form. Dr. Jacobs' Case 1 illustrates a retention of the fetal conformation, comparable at least generically to cases described by Sutton, Chill and Huntington."

ERRORS DUE TO ANATOMICAL ANOMALIES

Usually the length of the appendix, according to various authors, measures from 6 to 12 cm., but appendices as short as 4 mm. (Looten), or as long as 33 cm. (Graur, 1890, quoted by Kelly and Hurdon) have been reported. The organ may be represented only by a little dimple on the cecum, or by a small tubercle. It is possible that such cases may be included among those reported as true agenesis.

The appendix may appear only as a fibrous cord without any trace of pathology to explain this malformation. Monks and

Blacke found in 640 autopsies, 6 cases in which the appendix was represented by such a fibrous cord. The writer has observed two such cases, one in a patient 30 years of age, operated for fibroid uterus. In this instance a thin fibrous cord extended from the cecum near the ileo-cecal valve to the posterior peritoneal wall. In the second case a young woman was operated for recurrent attacks supposed to be due to a diseased appendix. Exploration showed only a conical bud, about 0.5 cm. long, continued from its tip by a thin fibrous, glistening ribbon about 1 mm. wide attached to the lateral peritoneal wall. Along the course of this ribbon there was a thin peritoneal apron, just as a mesoappendix would be. There were no adhesions.

It is hard to explain this anomaly, but adenoid tissue of the vermiform appendix is as elsewhere most developed in childhood and tends to atrophy in middle life. Coincident with this atrophy there is a tendency (the cause of which is not clear) in the walls to adhere, more or less obliterating the cavity. Piersol quotes Ribbert[1] as reporting that he found in 400 specimens more or less obliteration in 25 per cent, and putting aside those under twenty-five years of age, in 20 per cent. After fifty it occurred in more than 50 per cent. Merling, quoted by Lecompte, collected 2 cases where the appendix was transformed into a sort of ligament. Fleischman has noted it filiform and without a cavity in a portion of its length. The first case cited by the author might fall into the category of the case reported by Merling, and the second corresponds to that reported by Fleischman. Cases of appendices completely obliterated and adherent to the cecum have been reported. The fibrous cord may not resemble the appendix except in such a vague way as to cause a source of error.

The appendix may be arrested in an embryonal state. Clado who studied thoroughly the embryology of the appendix says that at about the tenth week of fetal

life the organ is well differentiated. It is possible that from this time on the cecum may continue to grow and that the appendix may be arrested in its development or grow very little. Dailey calls such arrest in development hypoplasia.

Usually the appendix is found in the right iliac fossa, occupying any one of four different positions, the most frequent, it is said, being downward. Next in order of frequency are the internal, the external and the ascending or retrocecal positions. Though the last position is the least frequent, it is well known to exist and may become a source of error. The appendix may occupy various retroperitoneal positions and a minute dissection is necessary to deliver such an appendix. It is possible that some of these cases may fall in the category of those reported as absence of the organ. Kelly and Hurdon have demonstrated the existence of a hidden rudimentary appendix in a case where it was pretended that it did not exist. Francis Dixon found at the dissection table an appendix 16 cm. long, which lay except at its very commencement and termination on the posterior abdominal wall, behind the peritoneum extending to the under surface of the liver. This instance of unusual position is mentioned a propos of the possibility of its being overlooked. A rudimentary appendix may closely simulate the appendices epiploicae and vice versa. A small vermiform process may be concealed from view in the peritoneal folds about the cecum, which are well developed in some instances.

Young in 1911 reported duplication of the appendix, the bases of the two being .06 cm. apart and each having a separate mesoappendix.

Congenital diverticulum of the vermiform appendix was reported by E. Hedinger: "In the distal third of the appendix were numerous outpocketings which either only reached muscularis or extended nearly through it so as to produce an uneven serous surface." Hedinger considers that in his case alone the congenital

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[1] *Virchow's Archiv.*, 1893, v, 133.

origin of the diverticulum has been established.

ERRORS DUE TO PATHOLOGICAL ANOMALIES

Dailey points out three pathological causes of error. The appendix may disappear from suppuration or gangrene. All surgeons have noted appendices with more or less destruction from gangrene. This destruction may be complete, later causing the appendix to disappear by absorption, adhesions having intervened to limit the infection. A gangrenous appendix may be expelled through the anus; such cases have been observed several times.

Velyaminov says, "During an acute attack of appendicitis the appendix may become gangrenous, and after becoming detached from the cecum, either falls to pieces in the pus, or, as a foreign body, it can settle in a nest of adhesions between intestinal coils, where it is very difficult or sometimes impossible to recognize its remnants." He quotes Sprengel as mentioning in his book two such cases, and himself saw one case.

In consequence of old inflammation of the peritoneum it is possible to find the appendix encountered by surgeons. Intussusception of the appendix has been cited by Merling as reported by several authors.

Reviewing the cases collected by Merling and quoted by Lecompte, only that of Meckel may be accepted as authentic, inasmuch as it was discovered during the course of a dissection preformed with great care, in which the cecum and adjacent organs were found free from any pathology and no trace of an appendix could be discovered. The reports of the earlier authors could not be accepted in some instances because of the failure to mention whether discovery was made at autopsy or on the operating table, besides lacking convincing details.

Newman Dorland tabulates 35 cases which may be grouped as follows: autopsy and dissection including museum specimens, 17; operation, 11; no mention, 7. Of these 35 cases, 16 only may be classed as true agenesis. Dorland, however, does not include in his table the other two instances of congenital absence of the appendix as seen by Gladstone—one in a fetus and one in a newborn infant. Of the two cases reported by Jacob Michaux from the operating table, in one the author has established in an indubitable manner the congenital absence of the appendix; the authenticity of the other, however, cannot be accepted as above criticism. The remaining descriptions have to do with instances of arrested development, or rudimentary appendices: the case of Roberts (1896) where there was "a dimple-like depression surrounded by peritoneal elevation;" Marshall and Edwards (1906) "a small papular elevation about 6 mm. across and 2 mm. high;" Looten (1908) "a small projection 4 mm. long," reported as a case of almost total absence of appendix; Bird (1911) "small pit in the cecal wall, ½ cm. in diameter."

Lecompte in discussing the reported cases divides them into three groups: first, those where the appendix alone is missing, the cecum normal; second, where the appendix and cecum are absent as the case of Robinson Byron, quoted by Deaver, and of Froelich quoted by Lecompte; third, where the appendix is absent, but the cecum somewhat longer than normal, and the unique case of Schridde, the cecum presenting six haustra.

To these the author would add the case of Morton (1912) in which the entire colon was absent and, second, a personal communication from Dr. Frank Cato, citing a patient with Meckel's diverticulum.

Lecompte remarks that in no one of the reported cases has there been noted the coexistence of another congenital anomaly. Marshall and Edwards in their report say that having searched in vain, they have found no other anomaly; also, Dailey says that a minute examination of the entire abdomen and thorax failed to reveal any other associated anomaly. However, such cases have been reported, as the specimen of Chill in the Museum of the Royal

College of Surgeons cited by Gladstone (congenital absence of appendix concurrent with epicephalocele). In Dr. Cato's case, as given above, the anomaly is accompanied by Meckel's diverticulum. To these there could be added the author's case of a true congenital absence of the appendix associated with a congenital malformation of the uterus and vagina.

Possibly a rigorous search of the literature would disclose further examples. Certainly it should be kept in mind that other defects actually existing may easily escape record in reports of appendiceal agenesis whether they are not revealed by inspection of a limited region or, being observed, are not reported in conjunction with the item of primary interest.

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THE RELATIONSHIP OF THE FEMALE SEX HORMONE TO THE ONSET OF LABOR[*]

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THE cause of the onset of labor has interested obstetricians for centuries. Hippocrates, for instance, supposed that the fetus, actuated by hunger, braced its feet against the fundus and forced its way into the world by its own efforts. Beard in 1897 published his speculations derived from studies in comparative embryology. He believed that the corpus luteum inhibited ovulation. Towards the end of pregnancy the corpus luteum degenerated so as to allow an ovulation at the end of a "critical" period. The preparation for the ovulation brought about parturition, comparable to menstruation when no pregnancy existed. That the question has not been satisfactorily answered is shown by a recent article by Knaus in which he reviews the newer theories and advances one of his own. Stimulated by published reports of the pygopagic Blazek Sisters,[1] Sauerbruck and Heyde in 1910 attempted to demonstrate labor-producing substances in the circulating blood by symbiotic experiments. The next year von der Heide concluded that labor is an anaphylactic phenomenon brought about by a foreign serum of fetal origin. The idea of the origin of the cause of the onset of labor has taken many forms in the past one hundred years. Naegele's belief was that the fetal membranes became detached towards the end of labor and thus acted as a foreign body. Placental infarcts have been thought to act in a similar manner. Many

other workers have believed that the biochemical relations of the mother and child were factors, but have been unable to bring forward convincing evidence to support their belief. The number of cases reported by Routh and others, in which normal labor has taken place in paraplegics, proves that the nervous system is not essential to parturition.

The proponents of the endocrine theories as to the onset of labor have centered their attention on the pituitary gland. Dixon and Marshall have shown that the intravenous administration of either pituitary or ovarian extract causes a marked increase in the amount of pituitary extract in the cerobrospinal fluid. No other glandular substance has such effect. They find that the corpus luteum dominates the ovarian metabolism, and that the ovarian secretion which at other times activates the pituitary gland is inhibited or else is neutralized by the secretion coming from the corpus luteum. The withdrawal of this influence, which occurs at the end of pseudopregnancy in the marsupial cat, opossum, dog and rabbit, allows the ovarian secretion to act in its usual manner in activating the pituitary gland. They suggest this as a possible mechanism for bringing about the onset of labor in true pregnancy. Knaus from his work upon the behavior of uterine muscle in various stages of pregnancy and at term, thinks that the cause of the onset of labor lies in the muscle itself, and that it is merely the expression of the physiological maturity of the uterine muscle.

Labor, however, is not simply a series

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[1] Basch reports that the non-pregnant sister stopped menstruating two months before term. She presented the same pigmentation of the skin that her sister did and had milk in her breasts.

[*] Read before the Marlboro County Medical Society, Bennettsville, S. C., January 12, 1928.

of powerful uterine contractions. Any one who has attempted to induce labor much before term knows that there is an added factor, *something that softens and makes the cervix more dilatable.* I recall a patient at the end of the seventh month who had pre-eclamptic toxemia. A Voorhees bag was readily introduced within the cervix,

uterine muscle. Slemons has shown that twenty-four hours before the onset of labor the output of nitrogen by the kidneys is considerably diminished. Zangemeister and Momm have noted a loss of weight in the last three or four days of pregnancy. It is a common clinical observation that there is often an increase in the systolic
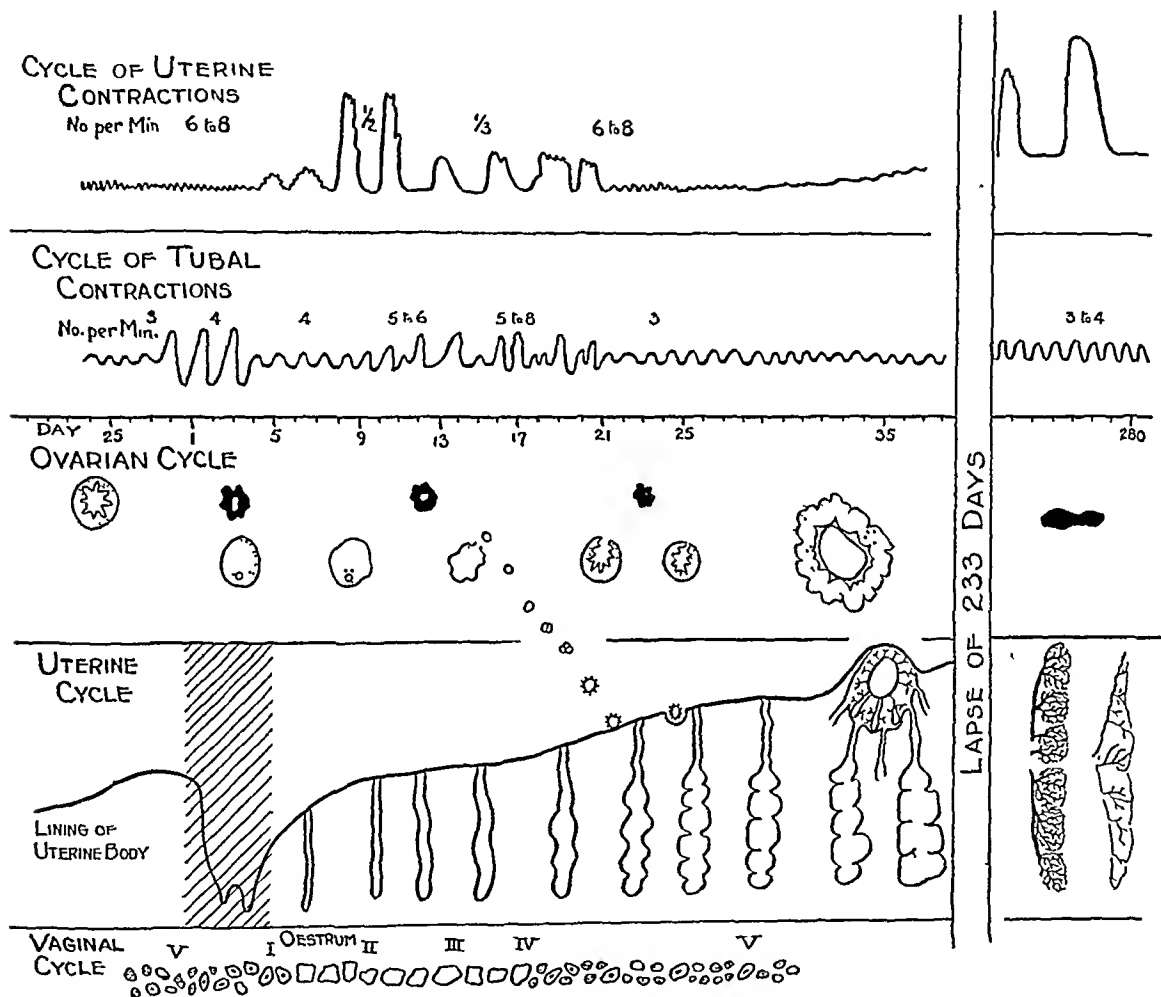
FIG. 1.

and for thirty-six hours this patient had regular uterine contractions of 180 mm. of mercury, which is five or six times harder than the usual first stage contractions. Yet there was no dilatation and she had to be delivered by vaginal cesarian section. Then, too, there are certain prodromal signs of approaching labor that seem too profound to be accounted for by simply a physiological maturity of the

blood pressure several days before labor pains begin.

Let us now for a moment review the newer work upon the female sex hormone to see if it throws any light upon the question. It is hard for us to realize that a hundred years ago no connection was seen between the ovaries and menstruation, and the importance of the corpus luteum was hardly dreamed of until Fraenkel's

communication in 1903.[1] Fraenkel destroyed the corpus luteum with a cautery in 9 cases at operation and the patient menstruated within two days. This led him to formulate his theory that the yellow body controls menstruation. Loeb, in the course of some experiments on the artificial production of tumors, found that deciduomata could be readily produced if there were present an active corpus luteum. At such times he was able to actually make a decidua reflex surround a glass bead. He maintained that there was nothing specific in the ovum, that any mechanical stimulus would cause the formation of the decidua if the uterine mucosa were sensitized by the corpus luteum. The relationship of the corpus luteum to the menstrual cycle has been abundantly confirmed by the work of Meyer and Ruge, Marcotty, Schroeder, Halban and Kohler and others, who have approached the subject from every possible angle.

In 1917 Stockard and Papanicolaou published their work correlating vaginal smears in the guinea pig with the histology of the ovum, from which has developed a test for the hormone of the corpus luteum. The histology and physiology of the genital tract at various stages of the growth of the ovum and corpus luteum in the sow have been put on a firm basis by Corner and others. By the use of ovarianectomized animals, chiefly rats and mice, as test objects, Allen and Doisy showed a growth-producing hormone in the theca fluid and the placenta of various animals and in the corpus luteum of human beings. Frank was able to find the substance in corpora lutea of various animals and thought Allen and Doisy's failure to be due to the method they used. It is now quite generally agreed that the function of this hormone is the stimulation of growth, especially of the reproductive

system. Beginning with the rupture of the Graafian follicle and later with the activity of the corpus luteum, there is an increased dosage of this substance sufficient to inaugurate and continue tremendous activity, especially in the uterus. If the ovum becomes fertilized, the corpus luteum continues to grow; otherwise retrograde changes take place in the corpus luteum and there is a consequent "house cleaning" in the uterus which we speak of as menstruation. These phenomena are graphically shown in a chart recently published by Dickinson showing the synchronization of the cycle of tubal contractions, the ovarian cycle, the menstrual cycle, and the vaginal cycle. The vaginal cycle in Dickinson's chart is that found in animals. Papanicolaou has attempted to demonstrate the same cyclic changes in the vagina of women but as yet has not been successful. Corner's recently published observations upon apes (macacus rhesus) would seem to show that these cyclic changes are not so simple as was at first thought. He found menstruation, or at least uterine bleeding, to occur at twenty-eight day intervals regardless of whether ovulation occurred or not. If ovulation did occur, it took place at a definite place in the menstrual cycle, and was followed by a characteristic premenstrual hyperplasia of the uterine mucosa. If the ovulation did not occur, there was no hyperplasia but only a uterine bleeding that was indistinguishable from the menstruation that took place when an unfertilized ovum was present. He thinks that there are some clinical facts that point to a similar condition in women. If this be so, there are two kinds of menstrual cycles indistinguishable clinically: one without ovulation and uterine hyperplasia and the other with ovulation and hypertrophy of the uterine mucosa. The Graafian follicle and corpus luteum sequence must be considered a part of a cycle of more fundamental nature, rather than the pace maker of the cycle. Be that as it may, the function of the female sex hormone is

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[1] The excellent work of Dalton fifty years ago on the corpus luteum has been buried in the *Transactions of the American Gynecological Society* and seems to have attracted little attention.

pretty definitely determined to be (1) the promotion of growth in the reproductive system as a preparation for the nidation of the fertilized ovum and (2) holding in check the natural emptying power of the uterus. If the ovum is not fertilized, retrograde changes take place in the corpus luteum and the uterus empties itself of the thickened mucosa, a so-called menstrual abortion.

If, however, the ovum be fertilized, the corpus luteum continues to grow, becoming the corpus luteum of pregnancy. Under the influence of increasingly larger doses of the female sex hormone, the uterus continues to grow. The breasts, vagina and tubes also share in the increased vascularity. Later the placenta is formed and takes up the burden of adequate supply of this hormone. Frank has found this hormone constantly in the blood of women shortly before they menstruate. Smith has attempted to show that the amount of hormone increases with the duration of pregnancy, culminating with a marked increase during labor and disappearing entirely within ten hours after labor. Her work is open to criticism in that it is based on only four determinations in labor. The rat unit upon which she relied for the quantitative determination of the hormone in the circulating blood is a variable standard. Coward and Burns have recently shown that this unit of measurement may be subject to as much as 1000 per cent variation.

Bouin and Ancel in 1914 advanced the idea that it is the withdrawal of the hormone furnished by what they call the myometrical gland, which they locate in the placenta, that brings about labor; that the uterus tolerates its growing burden only so long as it is under the influence of this hormone. Frank is convinced of the identity of the hormone found successively in the follicle fluid, in the corpus luteum and in the placenta. He advances the term "gestational gland" for these three structures and the name "female sex hormone" for its secretion.

How does the female sex hormone as an inhibitor of the natural function of the uterus of emptying itself, fit clinically? A theory for the causation of labor to be clinically satisfactory should account for (a) the prodromal signs as well as the actual onset of labor at term, (b) the difference in labor which is induced at or near term, and labor induced prematurely, (c) the difference in a spontaneous abortion and an induced abortion, (d) the symptoms of ectopic pregnancy, (e) the labor pains in abdominal pregnancy and finally, (f) should throw some light upon the treatment of threatened abortion.

THE ONSET OF LABOR AT TERM

A diminution of the growth-producing hormone would easily account for the stationary or declining weight that has been noticed at the end of pregnancy, where the picture is not complicated with edema. The lessened output of nitrogen in the urine and the rise in blood pressure are possible results of a change in endocrine balance. Marshall and Dixon's work shows that the ovarian extract, when not neutralized or inhibited by the corpus luteum, activates the pituitary gland and causes a demonstrable outpouring of pituitary extract into the cerebrospinal fluid. They advance this as a possible cause for the onset of labor. The physiological softening and dilatibility of the cervix, which for want of a better term I have been in the habit of calling ripening of the cervix, is an exaggeration of the premenstrual softening of the cervix and is the first direct evidence that the uterus is preparing to empty itself, as the inhibiting influence of the female sex hormone diminishes. Often there are 2 to 4 cm. dilatation which may be due to pressure of either the presenting part or the "fore waters" on the softened cervix or else to "false" pains. The actual onset of labor may be ushered in by the increased pituitary secretion, brought about in the manner demonstrated by Dixon and Marshall, acting on the physiologically

mature uterine musculature that Knaus has shown to be present at this time.

But what causes the diminution in the amount of female sex hormone? Histologically there is a marked and characteristic thickening of the blood vessel walls in the mature placenta. The beautiful injection experiments of Fraser show the same thing, i.e., that in the mature placenta there are blood vessel changes more marked even than the senile changes in blood vessels elsewhere in the body. It is conceivable, although this has not been proven, that such pronounced changes in structure are accompanied by diminution of function. Such a theory allows a certain amount of variability in the duration of pregnancy. In vicious implantations of the placenta, such as placenta praevia, the tendency to prematurity is brought about by the unfavorable location and by partial detachment of the placenta. The latter factor is the prominent one in ablatio placentae. It is conceivable also that the well-being of the placenta and consequently its hormone production is interfered with to some extent by increased intrauterine pressure, as in the case of hydramnion or multiple pregnancy.

The difference in labor when induced at or near term and labor prematurely induced is marked. When labor is induced at or near term with bags, instrumental dilatation of the cervix is not necessary. Labor pains start within a few hours and dilatation is complete within nine or ten hours as a rule. The induction of labor prematurely is a matter of days, and the introduction of bags must be preceded by instrumental dilatation. The "pains" are slower in starting in the premature uterus, but when once they have started the contractions are just as hard and frequent. They may even be more forceful but they accomplish little as measured by dilatation of the cervix. Very often there is no dilatation until after there is a considerable rise of temperature. Slemons has confirmed the work of Warnekros, who in cases of long labor demonstrated an infection of the placenta as a cause of such fever. It is my own idea that the cervix will not dilate while under the inhibiting influences of the female sex hormone. The rise in temperature is an indication of sufficient damage to the placenta to remove this inhibiting influence.

SPONTANEOUS ABORTION

In striking contrast to the difficulty of inducing premature labor or abortion is the ease with which a spontaneous abortion is accomplished. Many of the early ones are hard to distinguish from ordinary menstruation and even later ones may take place with surprising rapidity and ease. If the ovum dies the uterus cleans out itself as readily as it does at menstruation, but if the ovum be alive and the corpus luteum active the uterus resists to the utmost mechanical or therapeutic efforts. In this connection one should note the experience of veternarians who can produce abortion at will by mechanically rupturing the corpus luteum. Many of the most successful methods of producing abortion are aimed either at the integrity of the corpus luteum early in pregnancy or at the placenta later. It is possible that the abortion of a hydatidiform mole marks the end of the physiological activity of the corpus luteum. There being no placenta to continue the production of the inhibiting hormone, the uterus empties itself as completely as possible.

ECTOPIC PREGNANCY

Whether the ovum be implanted in the uterus or elsewhere, it in some way exerts a beneficial influence upon the corpus luteum. As long as it is alive the corpus luteum grows. When, however, the ovum dies, retrograde changes take place in the corpus luteum and uterine hemorrhage begins. This is an important fact clinically, not only in the diagnosis of the extrauterine pregnancy but also in the diagnosis of the death of the ovum.

ABDOMINAL PREGNANCY

The last time I had the pleasure of reading a paper in South Carolina, I had occasion to mention the work of Dr. John King of Edisto Island. An account of his remarkable case of abdominal pregnancy is reprinted in the November number of the AMERICAN JOURNAL OF SURGERY.[1] This patient had been in active labor for several days before Dr. King was called. He was able to deliver a living baby through an incision in the posterior vaginal fornix.

A more usual sequence of events in the cases of abdominal pregnancy that go to term is a period of labor pains, lasting from a few hours to several days, followed by the death of the infant. This to my mind is a clinical expression of what takes place in the placenta. The advancing senility of the placenta causes first a diminished production of female sex hormone with consequent symptoms of labor and finally an inadequacy in its circulation sufficient to cause the death of the fetus. No planned experiment could be better adapted to prove that the cause of the onset of labor does not lie in the physiological maturity of the uterine muscle, or to disprove the Naegele group of theories, i.e. that the fetal membranes or placentae act as a foreign body in the uterus. If von der Heide's theory of anaphylaxis from fetal protein be true, labor should have set in at the time of the tubal abortion in the secondary abdominal cases.

THERAPEUTIC CONCLUSIONS

If this theory of the action of the gestational gland be correct, it gives us an explanation for the frequent efficiency of the hypodermic use of corpus luteum in treatment of threatened abortion. It also emphasizes the desirability, in those cases where it is necessary to induce labor, of carrying the patient as close to term as possible.

CONCLUSIONS

1. That the Graafian follicle, the corpus luteum and the placenta, three structures to which collectively Frank has given the name "gestational gland," produce a hormone that has an important role during pregnancy, is well established.

2. That one of the actions of this hormone is the inhibition of the normal emptying power of the uterus, it matters not what its contents be, seems likely.

3. That a decided lessening of the amount of this hormone in the blood of the mother is the cause of the labor seems to fit clinically with the phenomena observed in labor at term, induced labor, spontaneous and induced abortions, extra-uterine and abdominal pregnancies.

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WIDE AMPUTATION OF THE RECTUM

BY THE COCCYX-PERINEAL ROUTE, IN THE VENTRAL POSITION OF DEPAGE

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IN his report to the 34th French Congress on Surgery in 1925, Ancelme Schwartz, one of the writers on the question of the end results of extirpation of cancer of the rectum writes: "If we visualize the lymphatic propagation of cancers of the rectum, a propagation almost always upwards with the hemorrhoidal plexus as the principal relay; if we visualize the rapid extension of cancer of the rectum by way of the perirectal connective tissue, perhaps very far from the area where the tumor is located; if we visualize, finally, the necessity of tying off the hemorrhoidal vessels far from the rectum and of removing the retrorectal fatty connective tissue layer up to the pelvic wall, one must realize that a purely perineal operation is not scientifically or theoretically a radical operation."

He thus rejected in this report perineal amputation, even if wide, and adopted the combined abdominoperineal operation which was laid out by Queno in 1896.

This was also the opinion of Lecène in 1924. "After all that I have been able to see personally," he said, "operations designed to remove cancer of the rectum must be extremely extensive in order to be efficacious. It is absolutely necessary to remove not only the area of cancerous bowel but also all the mesorectum and mesosigmoid with the glands which they contain. Now, it is scarcely possible to remove these glands solely by the perineal route."

Gordon Watson adds that since he has adopted the perineal method for all the tumors truly rectal, he has been able to operate on older patients, on more advanced cases, and on cases with more risk than he was able to do with the abdominoperineal operation.

Following the same train of thought, Pribam, of Leipzig, rejected the abdominosacral route as very dangerous, exposing the patient to peritoneal infection, to pelvic cellulitis, and to intestinal gangrene.

It has further been noted in checking up that the percentage of permanent cures did not increase by the adoption of the combined route. It is only necessary to remember that the hemorrhoidal group of glands, the extirpation of which is certainly facilitated by the use of the abdominoperineal operation, are always invaded late. The extension of the pathology goes on for a long time in the perirectal cellular tissue, and it is there that most recurrences appear.

When the surgeon operates on a cancer of the rectum he should remove from the pelvis the whole rectal sheath with the rectum; this is the principal maneuver, more important than the excision of the glands of the hilum. Now, astonishing as it may seem at first thought, this maneuver is not simple by the combined route. As Reinhold and Lambert point out, the abdominoperineal operation appears as an incomplete operation so far as removal of the rectal sheath is concerned. The low route only permits of its sure removal.

For several years we have ourselves abandoned the combined route, and have returned to the low route in the majority of cases.

In order that the operation used should

yield good results, the excision must be extensive, especially in width. Once the structure has been removed it should show that one has passed far from the rectum; posteriorly one should find all the fatty retrorectal layer with the branches of the superior hemorrhoidal vessels; in the sides one should see the middle hemorrhoidal vessels tied off far from the rectum. In
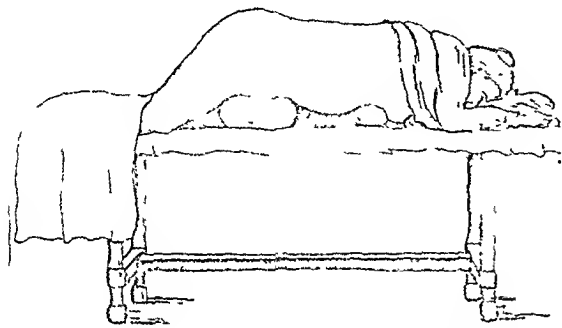
FIG. 1. The ventral position of Depage. Patient lies in ventral position, buttocks raised by a cylindrical bolster placed under the pelvis. The limbs are laid out and fixed at the edge of the table. Under the chest a flat bolster, slightly elevated, is placed. The head rests directly on the table.

front the muscular layer of the bowel should be covered over again, first by the peritoneum then by the vaginal wall in the female, and by the prostatoperitoneal fascia in the male.

How are these results to be obtained by the low route? The simple perineal extirpation (in the classic lithotomy position) limited to the soft parts of the perineum and to the subperitoneal region of the rectum, does not allow complete ablation of the retrorectal layer or access to the hemorrhoidal plexus.

The sacral route with the patient lying on the left side according to Kraske's method, permits a wider excision; most German surgeons employ it with good results. By resection of the bones the whole posterior surface of the rectum is brought into view as well as the three vascular roots and the retrorectal layer of tissue. As H. Steindl believes, the sacral route realizes the principal objects to which a rational method should aspire—easy access to, and free play in the operative field with the aim of a block extirpation of the

tumor and its glands. But this route necessitates an extensive resection of the lower part of the sacrum; the operative shock is increased and the gap in the bone may easily become infected.

Since we have given up the combined route we have practiced with success the coccyx-perineal amputation in the ventral position, following the method described by Depage of Brussels in 1901. This method has not the disadvantages of the sacral route. It permits rapid manipulation without much shock. It gives, above all, easy access to the rectal region, which permits complete removal of the rectal and perirectal lesions.

It is evident that the position in which the patients are placed from the beginning of the operation can facilitate the latter singularly. Thus the prognosis of abdominal surgery has certainly been greatly modified from the time Trendelenberg's position has permitted the isolation of the rest of the viscera during operations on the pelvic organs. Similarly, access to the biliary passages is much easier since Wheelock Elliott of Boston thought of putting a block under the thorax of the patient, producing a large exposure of the sub-hepatic space.

In a similar manner Depage thought that the classical lithotomy position was not the best for the extirpation of cancer of the rectum, and he proposed the ventral position.

The patient is placed on his abdomen. The buttocks are elevated by a cylindrical bolster placed under the pelvis; the limbs are laid out and fixed at the edge of the table. Under the chest a flat bolster, slightly elevated, is placed. The head rests directly on the table.

At the time when Depage described it, the ventral position received scarcely any attention from surgeons. Outside of Voelcker and Schlange all remained faithful to the lithotomy position.

In 1898 Jean Louis Faure and Riffel performed the perineal amputation in the lithotomy position. "It is necessary," they

said, "to approach the neoplasm from above, that is to say, beyond its limits, at a point where the tissues are healthy, instead of going from below to reveal the limits of the neoplasm and running the risk of leaving some degenerated portions in the lateral areas or at a higher point. When going from the bottom up one does not know where to stop; one hesitates, one

times in going from below up and from the front back, one clamps them from the start, achieving thus a preliminary hemostasis which makes the rest of the operation much simpler. The work of the assistant is also simplified. One knows how troublesome formerly were the many ligatures at the base of the perineal wound and that at times one had to lift them to per-
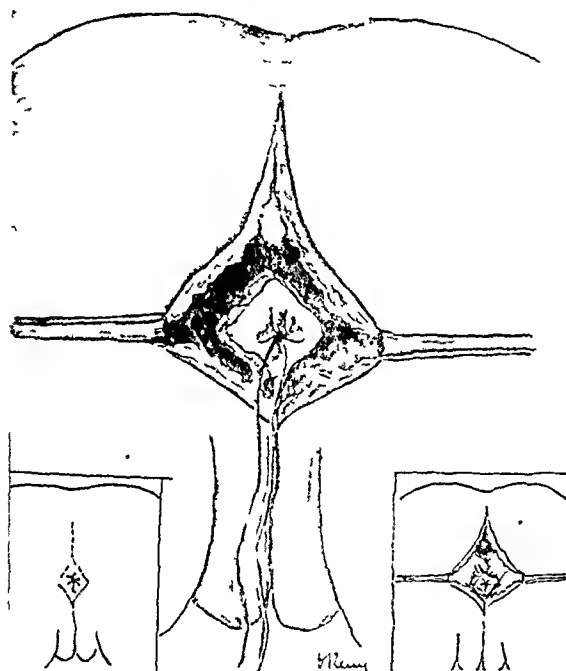
FIG. 2. Second Stage. After purse-string suture of the anus, incision following the outline in the insertion on the left, exposes the connective tissue of the ischiorectal fossa. Resection of the coccyx (insertion on the right).

FIG. 3. Posterolateral section of the supports as near as possible to the pelvic wall. (In the drawing this has been done a little too much internally). The rectum appears behind with its connective tissue sheath.

gropes in the dark, one strikes in the dark, and one does only poor work."

With the position of Depage one no longer works at the bottom of a pit but in the open atmosphere. Instead of being concerned with the anterior aspect of the rectum, that is to say, with the dangerous aspect, one approaches immediately the posterior aspect with the retrorectal tissues. Resection of the coccyx completes the exposure and permits, by loosening of the posterior portion of the attachments of the rectum, free access to the posterior and lateral aspects of this organ. The three vascular roots are easily marked out and instead of cutting the same arteries several

mit placing several clamps in the wound. In the ventral position, on the contrary, the vascular roots, which are superficial, are tied without any difficulty. Coming first to the rectum by its posterior aspect permits further the most complete removal of all the retro- and laterorectal sheath which contains the lymphatics and their glands, the first affected. This sheath appears by the resection of the coccyx and it is then quite simple for the operator to remove it with the bowel after sectioning its lateral attachments. The only point in the operation which retains its delicacy is the denudation of the anterior of the rectum in the male in front of the fascia of Denonvilliers, which should be taken away with

the bowel. This fascia presents a definite barrier between the lymphatic systems of the genitals and the rectum, but between the fascia and the rectum and in contact with the former, there is a compact plexus which constitutes an important avenue of diffusion, as Reinhold has insisted.

From this arises the necessity of incising the prostatic fascia up to the glandular

the table.

As for ourselves, we believe that spinal anesthesia is here especially indicated and we employ it with success almost routinely. L. Mummery, also, thinks that the risk of shock is greatly reduced if one gives up general anesthesia with ether or chloroform, for regional or spinal anesthesia.

Before passing to the description of our
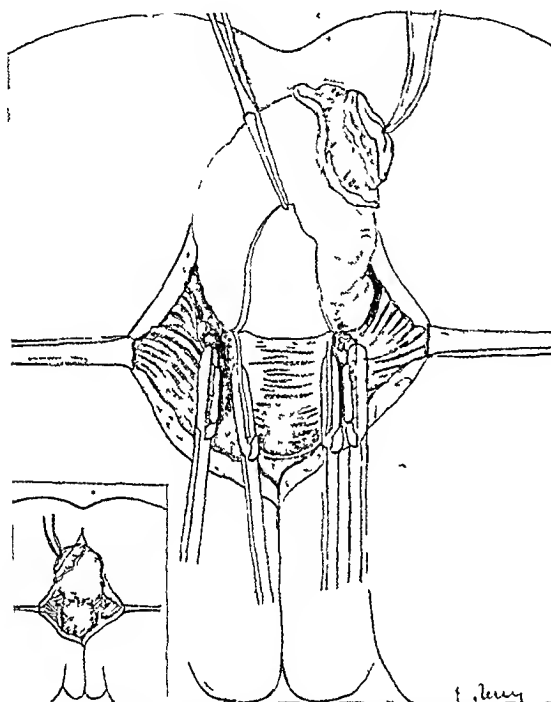
FIG. 4. Third stage. Liberation of the rectum anteriorly. In the insertion, view of the rectovaginal denudation. In the main drawing, the vagina is widely opened and its posterior wall is removed with the rectum.
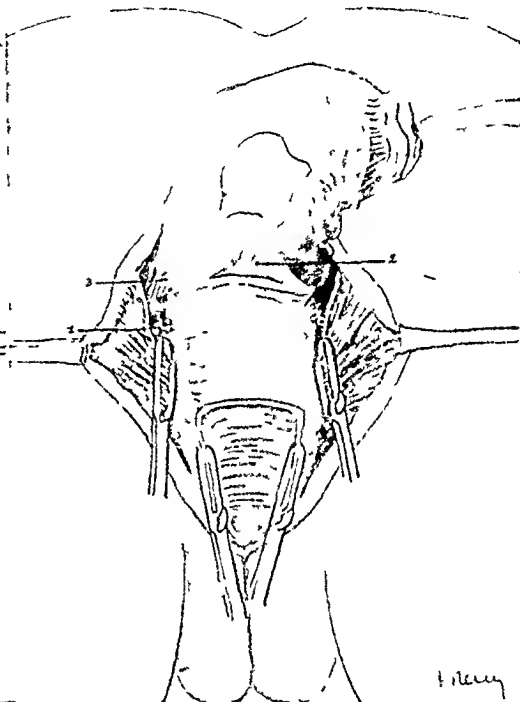
FIG. 5. Fourth and fifth stages. Ligature of the middle hemorrhoidal artery far from the rectum (at 1, the artery tied). Opening of peritoneal cul-de-sac (2). The superior hemorrhoidal arteries appear laterally (3) in the form of cords.

tissue, in a manner to produce by its extirpation a barrier to propagation anteriorly.

The preliminary introduction of a rigid sound into the urethral canal permits simple orientation and permits one to avoid the bulbar cul-de-sac and the prostatic urethra.

An objection to the ventral position has been that it renders difficult general anesthesia. As Depage says, this point should not be exaggerated, and an assistant who is used to the ventral position gives the anesthesia just as well though the head of the patient is turned toward

technique, we shall conclude these considerations by pointing out the gain of time which is possible by the method of Depage. Whereas by the perineal route in the lithotomy position, we take more than an hour to perform an amputation of the rectum, by the coccyx-perineal route in the ventral position our operation does not last more than a half hour.

OPERATIVE TECHNIQUE

It appears to us indispensable always to produce an artificial anus, which puts the lower end of the bowel at rest. Further, in

the course of this preliminary operation, an intra-abdominal exploration informs us of the extent of the lesions. The reasons invoked in favor of a perineal anus at La Societe Francaise de Chirurgie in 1920 (Quenu, Duval, Cuneo) are essentially of a sentimental nature. The disadvantages of this form of anus, on the contrary, are real: the danger of contamination of the operative field from the distal end of the colon, secondary incontinence of this perineal anus without preservation of the sphincter, and the great difficulty of keeping clean.

We place the artificial anus in all of our cases in the left iliac region. The procedure is executed with simplicity and rapidity, and thanks to various operative artifices in its method of closure, (Schwartz, 1922; Cuneo and Lambert, 1923), it is from the functional point of view incontestably superior to the perineal anus.

That which the preliminary iliac anus gives above all, as we have said above, is the rest to the diseased rectum. The phenomena of intoxication disappear; the tumor is no longer irritated by the continuous passage of fecal material, and the ichorous and glary discharge often so painful to the patient diminishes and sometimes dries up. The inflammatory processes are limited; the mobility of the neoplasm is increased, especially if to the benefit of the artificial anus are added the mechanical and chemical actions of disinfection by antiseptic lavages.

The Amputation. In general the disinfection of the isolated rectum is satisfactory at the end of 15 days. One takes advantage of this period to build up the general health of the patient (serum, digitalis, vaccine therapy, transfusions in certain cases).

On the day set, we perform a very extensive operation. The following are some essential principles upon which it rests:

(1) Extensive freeing of the rectum with its sheath and all the tissue which surrounds it.

(2) Opening of the peritoneal cul-de-sac.

(3) Removal of the rectum in toto.

This technique is slightly different in the male and in the female. We shall study it first in the male.

Position. This is the ventral position which we have described above. The operator should place himself on the left in such a manner as to make sure the freedom of his right hand; a single assistant is
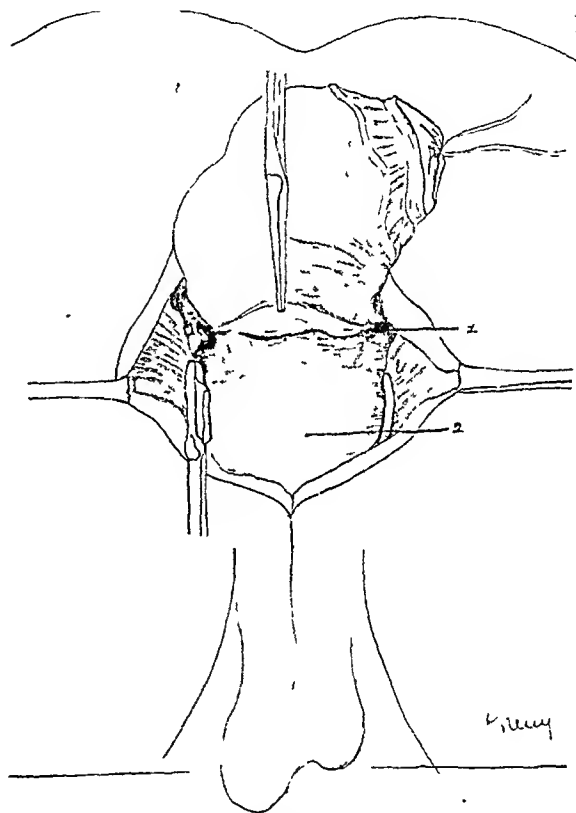
Fig. 6. In the male. Liberation of the rectum anteriorly (different in the male and in the female). After section of the anobulbar raphe one penetrates into the retroprostatic plane of cleavage and one carries away with the rectum the fascia of Denonvilliers. In the bottom of the genitocrural denudation one notes the peritoneal cul-de-sac (1). The prostate covered by the seminal vesicles (2).

placed opposite the operator.

First Stage. Purse-string suture of the anus with a thick linen thread is made. A generous bite of the perineal tissue is taken about a centimeter around the anal orifice. In this manner, leaving the thread long enough, one has a firm means of traction, without which one must fear tearing the anus.

Median incision is made extending from the sacrococcygeal articulation to a point two centimeters from the anal orifice. It then divides into two branches which pass around the anus at a distance of two centimeters, and rejoin anteriorly (an anterior incision the length of the anobulbar raphe being most often not needed except in cases of close adherence of

FIG. 7. Seventh stage Closure of the peritoneal cul-de-sac with fine catgut, and section of the cancerous rectum in toto. In the insertion, suture of the lateral walls of the vagina to fill the gap of the resected posterior wall.

the tumor to the bulbar urethra or the prostate).

Section of the connective tissue with wide scooping of the two ischiorectal fossae; several ligatures on the arterioles of the region.

Second Stage. Resection of the coccyx and posterolateral section of the rectal supports; liberation of the edge of the coccyx with bistoury and rugine and section at the sacrococcygeal articulation (either with Liston's forceps or with a heavy chisel).

Several fingers are passed via the coccygeal gap into the sacral hollow to denude and liberate the presacral fascia as far off as possible.

Hemostasis of the sacral vessels is

obtained either by ligature or tampon. Then with the index finger the rectal supports are attacked, going on each side from behind forward. These are sectioned, keeping as near as possible to the pelvic wall.

Third Stage. Liberation of the rectum anteriorly. The assistant, using traction, lifts the rectum up high. The anobulbar
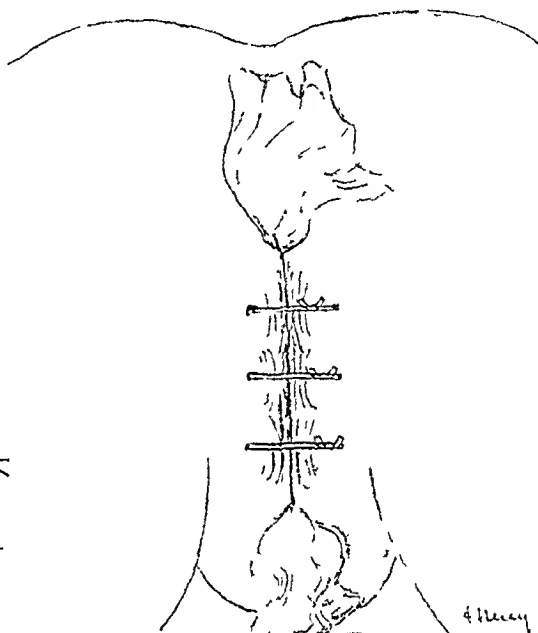
FIG. 8. Eighth stage. Partial suture of the perineal wound, isolating the stump of the bowel by several drains. A vaginal drain.

raphe is sectioned carefully to avoid opening the rectum or the urethra. The finger is placed in the retroprostatic plane of cleavage. The prostate is recognized and the fascia of Denonvilliers on it is incised; and one does not hesitate to enter into the glandular parenchyma in order to do this.

Fourth Stage. Section of the middle hemorrhoidal artery and liberation of the lateral aspect of the rectum.

The rectum is drawn by the assistant first to the right then to the left to stretch the vascular roots which appear as cords in the midst of the connective tissue coming from the hypogastric area. Ligature and section of the fibrous bundle of the middle hemorrhoidal as far as possible from the rectum, in such a manner as to take in the arterial trunk itself beyond the

accessory branches which go to the rectum.

Fifth Stage. Exposure of the peritoneal cul-de-sac. In bending the rectum upward opposite the sacral gap, the operator finds in the bottom of the genitorectal denudation, the peritoneal cul-de-sac in the form of a whitish sheet. It is carefully incised and picked up with forceps. The abdominal relaxation due to the spinal anesthesia keeps the small loops from entering across the gap. At this time the rectum tends to present itself externally.

Sixth Stage. Section of the superior hemorrhoidals. The mesosigmoid presents plainly; its attachments are cut laterally and posteriorly, and one then notes clearly the cord of the superior hemorrhoidals which is tied and cut as high as possible. At that time the mobility of the rectum is almost complete and nothing opposes its lowering.

Seventh Stage. Closure of the peritoneum with fine catgut sutures from the anterior lip of the cul-de-sac to the anterior aspect of the sigmoid. This stage fixes the sigmoid.

Eighth Stage. Section of the cancerous bowel between two ligatures, at least two finger breadths above the upper limit of the tumor. Fixation of the sigmoidal stump to the skin by several stitches in the middle portion of the incision. Partial suture of the perineal gap, while isolating the stump of the bowel by several wicks which protect the peritoneal cul-de-sac and drain the sacral hollow.

In the Female. The coccyx-perineal amputation in the ventral position is more simple than in the male. The operator need not fear the dangerous zone in the latter formed by the urethral bulb and the prostate. The posterior vaginal wall is actually invaded by the cancer in most cases but it is very easily resected with the rectum. At the end of the operation a useful vaginal canal can be reconstructed from the lateral walls.

INDICATIONS FOR OPERATION

This purely perineal technique does not pretend to be applicable to all cases described under the name of cancer of the rectum. High tumors or intraperitoneal tumors developing at the top of the rectal ampulla and in the rectosigmoid region appear to us without contestation to call for the abdominal route for which we adopt the technique of Hartmann, recommended recently by Soupault. The affected lymphatics in these tumors are in fact lodged in the thickness of the mesosigmoid, as Villemin has shown, and this type of rectal cancer approaches closely to the cancers of the colon.

On the other hand, in all the cancers situated lower down, subperitoneally, our technique appears to us the one of choice. As we have already pointed out, in the actual form of rectal cancer, the lymphatic involvement from the beginning takes in the perirectal connective tissue structures, to which the operation in the position of Depage gives considerable access. The lowering of the colon furthermore allows one to reach the rectosigmoid glands, which however are not involved till late.

OPERATIVE RESULTS

Since 1925, when we adopted the ventral position, we have had occasion to operate on 21 cases of rectal cancer (anorectal region and region of the ampulla) without any operative mortality. The immediate after effects were slight, the shock of little importance. Pain is felt only the few days which follow the operation and the removal of the drains.

We use routinely anti-gangrene serum. We limit ourselves to local daily washings of the wound with Dakin's solution.

The end results are equally good in our 21 cases, a single patient, operated in 1926, dying of generalized carcinomatosis at the beginning of 1927. Three have been lost from view; the others are in good health.

EARLY AND LATE SURGICAL TREATMENT OF
CARCINOMA OF THE COLON*

REA SMITH, M.D., F.A.C.S.

LOS ANGELES

THE surgical treatment of tumors of the intestinal tract must of necessity deal largely with carcinoma of the colon. We have, however, both benign and malignant tumors of the small intestine occurring occasionally and necessitating operative treatment on account of obstruction. A polypus or fibroma arising from the lining mucous membrane is often the cause of intussusception. Many times they completely fill the lumen of the small intestine before the symptoms are aggravated enough to call the special attention to any trouble in this region, due to the liquid contents of this section of the bowel. Carcinoma of the small intestine may be either primary or secondary, and is not frequent. However, carcinoma of the small intestine by contact and extension from other tumors in the abdomen are more frequently met. In any case a resection with an end to end anastomosis is the treatment of choice. It is often possible in dealing with an obstruction due to polypus or fibroma to open the intestine, remove the tumor, and close the incision in the bowel without resection. This condition is easily demonstrated at operation by the fact that the obstructing mass inside the intestine is freely movable in its long axis for a distance of from one to two inches. I have on several occasions been able to remove these movable tumors through a longitudinal incision in the intestine, clamping and tieing a small pedicle and closing the incision crosswise to prevent obstruction.

The tumors of the large intestine are more frequent, give very few symptoms until they become obstructive and present a more difficult problem. For consideration of treatment we shall divide the colon into three parts: cecum and ascending colon, including the hepatic flexure; transverse colon, including the splenic flexure; and descending colon. The five years results after excision of carcinoma of the colon are the best in the body, with the exception of carcinoma of the lip. The further to the left we go the better the end results, due to the fact that the further to the left we go in the colon the less absorption takes place and the fewer are the lymphatics subject to metastasis, so that left-sided carcinoma usually remains a local disease and very radical surgery can be performed with a good end result, providing the disease is entirely removed.

The cecum is the absorbing organ of the colon. It has five chains of lymphatic glands following the blood vessel; therefore, any operation on this condition in the ascending colon must be radical enough to remove the lymphatics along the ordinary course of extension. If it is necessary to impair the circulation of the colica dextra just above the cecum, a resection around the hepatic flexure must be done to insure circulation in the anastomosis. While the hepatic flexure sometimes draws its blood supply from the mid-colic artery, it is often supplied by the colica dextra so that a suture line is not safe unless it is well in the circulation of the colic media. If the tumor in the transverse colon is so situated that the mid-colic artery must be tied in order to follow down the lymphatic extension, the splenic flexure must be removed in order to insure blood supply to the stitch line. However, the loop of the mid-colic is so long that it is usually possible to remove a tumor in the transverse colon without endangering any circulation but that con-

* Read before the Los Angeles Surgical Society, March 11, 1927.

cerned with the part of the intestine involved in the tumor.

In carcinoma of the cecum and ascending colon when the diagnosis is made before obstruction takes place, the technic of Mayo right-sided colectomy is the simplest and gives, I think, the best mechanical result. The cecum and ascending colon are mobilized by cutting the outer leaf of the peritoneum. The ascending colon develops a long mesentery and can be turned toward the mid-line. The right ureter, duodenum, and right kidney are exposed and covered with a warm pack. The ileum is clamped not closer than four inches from the ileocecal valve, again to insure circulation to the bowel as the ileocolic artery often supplies the terminal three or four inches of the ileum. The vessels are tied, the mesentery divided around the hepatic flexure, the colon removed with cautery over a Pyer clamp. A running stitch is put in over the Pyer clamp to close the open end and the clamp removed. The female half of a large Murphy button is dropped in the open end and the colon closed by tightening the running stitch. A second row of mattress sutures over the suture line makes it safe. The male half of the Murphy button then is placed in the open end of the terminal ileum with a catgut suture. The button in the colon is brought up against a longitudinal band and let through a small incision and the button snapped together. A few linen and silk Lemberts protect the anastomosis from pull. It is now possible to sew the edge of the mesentery of the ileum to the edge of the mesentery of the transverse colon, and to close in the denuded surface over duodenum and kidney. The advantage of the button over a suture anastomosis, as claimed by Dr. C. H. Mayo, is that it molds the adhesions surrounding the anastomosis and insures a wide lumen.

Tumors in the middle of the transverse colon which can be removed without ligation of the colic media are most easily handled by resection and end to end

anastomosis by suture. Ordinarily the blood supply is easily demonstrated, the colon is very mobile, and the abdomen can be easily protected from infection. The aseptic anastomosis of Collins should be particularly applicable to this location. The sigmoid and rectosigmoid junction contains the largest number of carcinoma. When the abdomen is opened and it has been demonstrated by palpating the liver that there is no general metastasis, almost every carcinoma of the descending colon should be considered operable. By cutting the outer leaf of the peritoneum and mobilizing the sigmoid, it is surprising what large masses of carcinoma can be freed in this location. The tubes and ovaries in the female, or back wall of the bladder in the male may be involved. In each case they can be removed with the mass, as also can adherent loops of small intestine, making multiple end to end anastomosis by suture or button. The left ureter may be involved, in which case the involved portion can be resected with the mass and both ends of the ureter ligated without expecting any difficulty from the kidney. When mobilized the question of anastomosis in this location is a more serious one, as the percentage of deaths from a leakage from the eighth to the twelfth day, followed by general peritonitis, is very high in comparison with that for the same procedure by suture that does well in the small intestine or transverse colon. If the tumor is small, particularly if it is situated at the rectosigmoid junction, the artificial intussusception over the tube is easy of performance and is not prone to be followed by secondary leakage. The tube is passed through the open end of the distal part of the colon out of the rectum, the other end back into the open end of the proximal part for several inches; a stitch is put through the proximal edge of the colon and through the tube, tied, and cut. The ends are then brought together by the assistant pulling on the tube from below. A few through and through stitches

connect the two open ends of the bowel. The assistant then makes traction on the tube below, invaginating the anastomosis for about one inch. A row of interrupted Lemberts are placed to prevent the unrolling of the invagination and complete the anastomosis.

If the tumor is higher in the sigmoid and large, the three stage Mikulicz gives by far the best results in spite of the rather distressing convalescence. The two legs of the bowel as far away from the tumor as possible are approximated by Lembert sutures to hold them in contact. The loop of the bowel that contained the tumor is then drawn out of the wound. The peritoneum is attached around the two legs beneath the tumor. It is possible in freeing the tumor to follow down the vessel and remove a large wedge of mesentery with glands attached to the mass. On the second or third day after, the tumor is removed with cautery without anesthetic, leaving in the wound a gun barrel of two open ends of the bowel. About the tenth day an enterotribe is passed into the bowel, one blade into each segment to cut through the spur. This takes from four to five days to cut through by pressure necrosis.

During the process of cutting through, a firm anastomosis by inflammation is established between the two legs of the bowel inside the abdomen. It is imperative to be sure that the spur has been divided well down. It may be necessary to apply the clamp the second time to assure plenty of room when the fistula closes. After the removal of the clamp the colostomy becomes healed. The mucous membrane becomes united to the skin edge, walling off the rest of the wound. At this time, under gas or novocaine, the bowel may be separated from the wall, turned in by suture and the muscle closed over. This third stage is usually followed by fistula, which always heals spontaneously, the bowel edges having been inverted by the suture line.

If complete obstruction has developed before the patient comes to operation, an enterostomy or colostomy will usually have to be done to remove the urgent symptoms before these radical procedures can be attempted, although it is often possible to use the method just described in the sigmoid, lifting the tumor to the outside of the abdomen even in the face of complete obstruction and then relieving the obstruction with the Pahl's tube in the upper segment, either removing the tumor at the same time or leaving it for walling off. Diverticulitis of the sigmoid may simulate carcinoma so that only the microscope will make the diagnosis. It is much more likely to be accompanied by abscess and if not unduly obstructing, the drainage of the abscess will usually take care of the condition without resection. If obstructing, resection as in carcinoma must be done. In my experience the vesicle fecal fistulas have all proven to be diverticulitis and not carcinoma. Carcinoma apparently does not break through into the bladder even if it becomes attached as readily as does the suppurating diverticulitis.

May I add one word about complete obstruction, which has to do with the preparation of the patient for operation? It has been demonstrated rather recently that in complete obstruction the blood chlorides are low. The intravenous administration of the concentrated sodium chloride solution changes the picture of these desperate cases miraculously. It seems to act as an antidote to the toxemia. Vomiting stops, the pulse drops, the vasomotor tone returns and apparently hopeless operative risks may be changed into relatively good risks in a very short space of time by bringing the blood chloride back to normal. This should not, however, lead us to rest in false security because the symptoms have subsided. The abdomen should be opened as soon as the reaction has taken place, for the change to bowel tissue from constriction is not lessened by the salt but still goes on even after the symptoms have temporarily subsided.

SETTING FRACTURES
BY AN ELECTROMOTIVE DEVICE

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NEW YORK

IN the realinement of an overlapping shaft or joint fracture, traction and manipulation is a basic procedure. Traction is either manual or mechanical. It has long been recognized that manual traction is often unsuccessful, and for that reason resort is to mechanical traction best represented by "fracture tables" (immediate traction) or by "straps" (intermediate traction) glued or otherwise fastened to the extremity. Skeletal traction represents another phase of the problem, as does "open reduction" in which direct traction by leverage is employed.

The choice of methods is very largely a matter of personal selection based upon the experience of the surgeon, the type of the fracture, the physique of the patient and the available facilities.

It is conceded that immediate closed reduction is the method of choice in the vast majority of cases. If reduction is made within the first six hours after injury, swelling, spasm of muscle and other complications will be less marked than after this optimum period. Unfortunately, however, a broken bone is not as yet regarded as an emergency requiring the prompt attention given to a broken appendix. For this and other reasons, delay is the rule; we give as our excuse "need for roentgenograms," "fear of secondary swelling" and the like.

Manual traction usually requires anesthesia.

Strap traction means considerable expenditure of time and the use of much apparatus, even in a well equipped hospital. The after care and daily supervision of a case in traction and suspension is of importance.

Skeletal traction and open reduction are of course problems in operative bone surgery. It was long ago recognized that if we had some mechanical device to separate the fragments safely and speedily, some of our difficulties would be solved. Hence from and before the days of Hippocrates, a pulley or windlass device has been employed. Fracture tables are but refinements of this principle. Traction and suspension arose from Buck's extension which in turn was evolved from a plan in use in this country long before the Civil War. The type of apparatus may change but the principle of traction is fundamental.

Recently the writer has been using with success an electric motor device and an appropriate set of traction straps or "harness" for stiff joints. The control in this apparatus is so regulated that a measured pull or thrust is followed by a period of relaxation or rebound. The speed of the motor can be fixed, and the force of the pull can be set and measured in foot pounds, and either increased or decreased by three separate attachments. Realizing that this principle of pull-and-let-go was adapted to the reduction of certain fractures, we tried it out. Below is a report of the initial experience with this contrivance as a fracture reduction method.

H. B. aged thirty, was admitted by ambulance to the Port Hospital January 10th, 1928, at 12 noon. Shortly before this he had been thrown into the hold of a vessel by a swinging load of timber. There was a compound fracture of the lower third of the tibia and fibula (Fig. 1), the wound of puncture type, freely bleeding. Four hours after admission the fracture was partly reduced by manual traction and a plaster of Paris casing applied, a window giving access to the wound. A subsequent roentgenogram showed the adjustment to be incomplete (Fig. 2). Six days later (January 16th, 1928) a four inch encircling cuff was removed from the plaster of Paris casing directly over the fracture
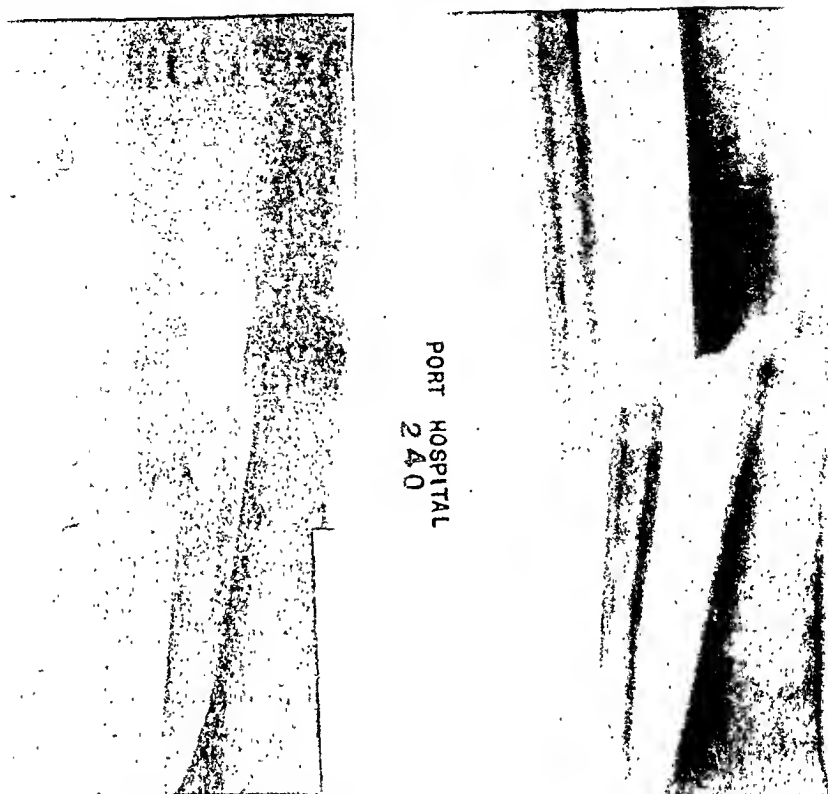
FIG. 1. Fracture of tibia and fibula, before reduction.

FIG. 2. After manual traction and application of plaster of Paris casing, with window cut out.
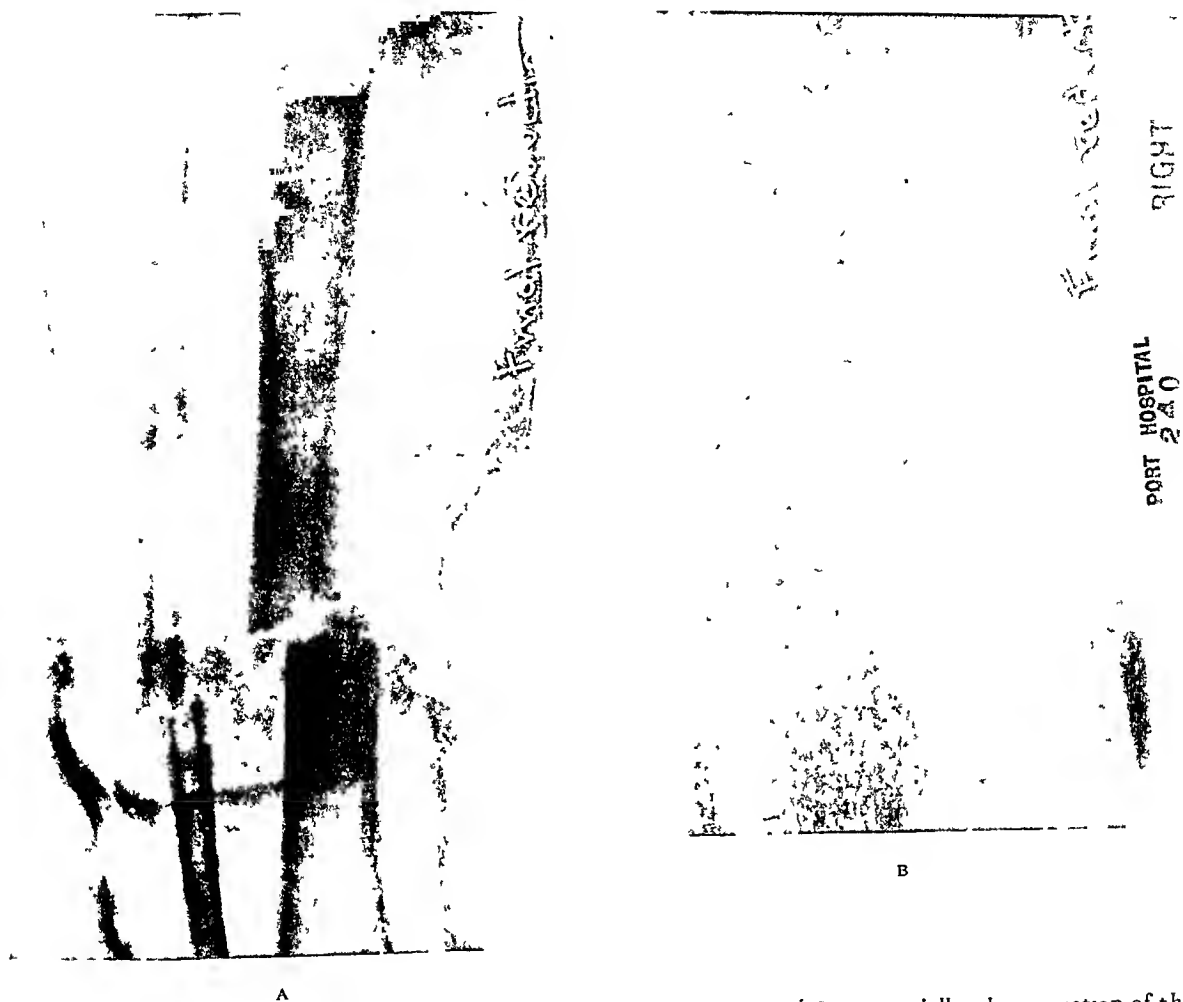
FIGS. 3A and B. Showing electromotive reduction and end-to-end contact. Note especially the correction of the overlapped fibula and the notching of both bones.
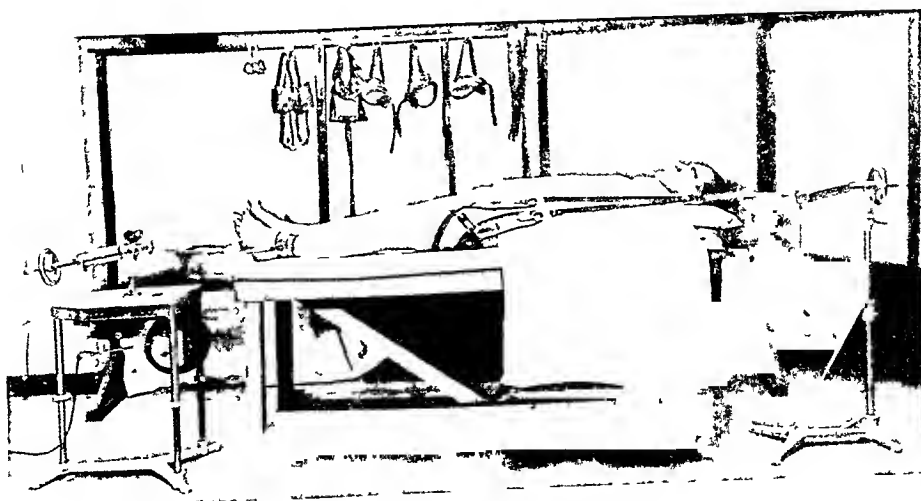
FIG. 4. Electromotor reduction.
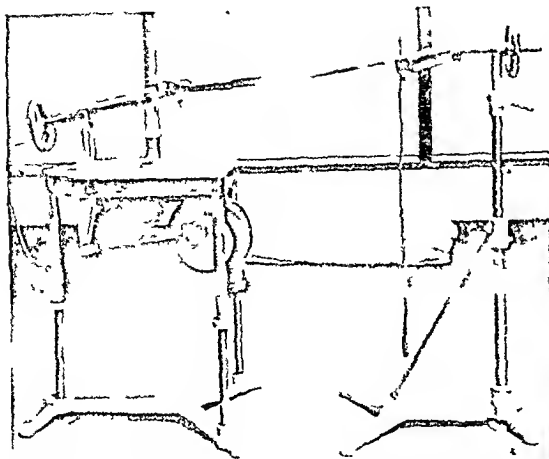
FIG. 5. Showing one side of the motor and two uprights.
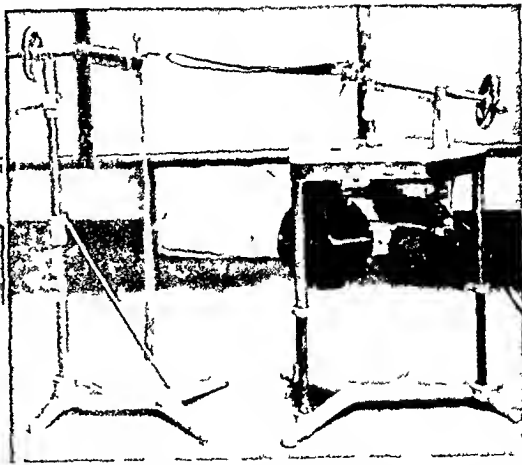
FIG. 6. Showing another side of the motor and the eccentric controlling the rate and extent of the pull-and-let-go mechanism.

site and the healed wound. The harness of the apparatus was fastened about the lower end of the plaster casing, and the counter-pull part of the harness was fastened to the upper thigh. The motor was then started at a slow rate. We were able to observe the gap in the plaster widen and, from the patient's audible comments, had no doubt as to the traction being accomplished. When palpation showed very free false motion and crepitus, we stopped the motor in a period of pull, and thus held the limb in the limit of extension we had attained. This proceeding took but a few moments. The leg was now supported on sandbags (still held in extension by the harness) and the gap in the plaster casing was filled in by plaster of Paris. Immediately a roentgenogram was taken in the corrected position (Fig. 3). Figure 4 shows the attachment as for fracture of the leg. Figures 5 and 6 show details of the device.

If subsequent experience is equally successful, the writer feels convinced that many long bone fractures, now requiring prolonged skeletal traction, can be adequately adjusted by this device. For example, overlapping fractures of the radius and the ulna may be taken out of the operative class thereby. Fracture-dislocations will be especially amenable. Uncomplicated dislocations naturally lend themselves readily to this type of controlled and controllable manipulation. As intimated, the "harness" is adaptable for any part of the body: joints, long bones, fingers, toes, spine, hip and pelvis.

It is not improbable that in the future our reduction will be made on a roentgenographic table so that under the guidance of the fluroscope an exact visual control will be possible.

It is understood of course that this method is only feasible in that large group of cases in which subcutaneous notching is attainable. When, however, the fracture lines are of the smooth or non-serrated, long oblique or transverse types, it is questionable if this or any other immediate traction procedure is applicable. It is realized that when we can obtain and retain end-to-end instead of side-to-side anastomoses of broken bone, we perform the maximum in first stage repair.

This device, based on this initial experience, is worthy of further trial in selected cases, because:

1. It is safe.

2. It permits automatic, regulated, immediate reduction, with or without anesthesia, with or without roentgenographic control.

3. It is adapted to early cases (within the six hour "incubation" period) and to the late or unreduced group, and to some of the group classed by the writer as the "irreducibles" in which prolonged traction, skeletal traction or open reduction has hitherto been the remedy.

4. Because of simplicity and exactitude, it will encourage early reduction and

retention and thus put a larger group at once into the finished class, due to this one act of definitive reduction.

5. A plaster of Paris casing can be applied above and below the fracture site, and this gap can be later filled in after the motor controlled reduction has been obtained. In this way any pressure on the limb can be prevented as the lower end of the "harness" is buckled over the plaster casing and the upper part of the "harness" is distant from the fracture site, acting in effect like a perineal post of a fracture table.

This apparatus is made by the Articulator Company of Detroit, and in a proposed modified portable form the value of the appliance will be enhanced for the purposes above described. In the vicinity of New York it is handled by the Hospital Supply Company.

POINTS IN THE TECHNIQUE OF
KIDNEY STONE OPERATIONS*

EDWIN BEER, M.D., F.A.C.S.

NEW YORK

IN kidney stone operations the two most important desiderata are, first, to remove all the stone material, and second, to destroy the kidney parenchyma as little as possible.

In 271 stone operations between 1921 and 1925, I find that in 18 per cent of the cases a nephrectomy was necessary because of the destruction of kidney tissue. In 5 per cent of the cases, owing to the extensive disease of the opposite kidney, or to the fact that the stone was in a solitary kidney, the stones had to be removed without dislocating the organ. In the rest of the series, the operation of choice was a pyelotomy, with or without a small nephrotomy or a wide nephrotomy. In the last 38 personal cases, the same percentage of nephrectomies obtains, but 29 pyelolithotomies were done, and only one wide nephrolithotomy. This very definite swing towards regular pyelolithotomies, with or without small nephrotomies, spares kidney parenchyma, and owing to the cooperation of the roentgenologist, complete removal of all stone material is obtained.

To remove stones by a wide pyelotomy incision which may extend into the adjacent parenchyma, the kidney must be carefully exposed and, if possible, well delivered. Through such a pyelotomy incision with care even the most complicated stones can be delivered. And if the shape of the stone is such that its base or widest portion is near the cortex, such pieces should be removed through a small caliceal incision through the cortex. Before stones are removed the ureter should be carefully constricted with ligatures so that no fragments can fall down into the ureter. After the surgeon feels that he has removed all the stones that can be easily recognized, the kidney is photographed and the film immediately developed. This will show at once whether any fragments have been left behind, which occurs in a good number of cases despite the greatest care and despite the fact that the kidney had been thoroughly irrigated before the pictures were taken.

If the kidney cannot be delivered, it may be necessary to do a nephrotomy to get at the stones. Under these circumstances, we regularly throw a rubber tourniquet around the pedicle, so that the operation is done under complete ischemia. Even these kidneys lend themselves to roentgenography, and in such cases, although it is more difficult to get a complete picture of the undelivered kidney, the information obtained is of value.

In past years we regularly dreaded fragmentation of stone during delivery, but nowadays, with roentgenographic control of the exposed kidney and the immediate development of the films, no such fear of leaving fragments behind oppresses the surgeon. In about 30 cases where the stones were of a complicated shape, the kidneys have been roentgenographed in the operating room, and in about one-half of these fragments were found still present and usually easily located and removed.

*Read before Section of Genito-Urinary Surgery, New York Academy of Medicine, December 21, 1927.

EFFECT OF NEPHROTOMY ON RENAL FUNCTION

INCISION AND SUTURE*

EDWIN BEER, M.D., F.A.C.S.

NEW YORK

ONE of the difficulties in kidney surgery is to decide whether the second kidney is really perfectly adequate. It is well known that a normal secretion can take place from a hypoplastic kidney, and if one removes the other kidney, such a hypoplastic kidney may be inadequate. Geraghty thought that these hypoplastic organs could be recognized preoperatively. Fortunately, in my experience I have never encountered a situation where I had to rely upon such an undeveloped organ following nephrectomy on the other side.

The value, however, of our various tests can be experimentally studied on a kidney that has been nephrotomized and sutured. About a year ago such a nephrotomy was done by me from pole to pole, and closed with a double layer mattress suture as well as hemostatic sutures on the cut surface to control bleeding. This patient has been repeatedly examined since then to determine whether that particular kidney was deprived of any great degree of functional ability by the operation and suture, and much to my surprise the urea percentage concentration, the indigo carmin concentration, and the phenolsulphonephthalein output have been very slightly changed from that of the normal opposite side.

Years ago I noticed that concentrated indigo carmin could be discharged through a lumbar sinus from a small residue of healthy parenchyma which had been accidentally left behind. In the case recently studied, to which I am referring, very similar qualitative as well as quantitative output has been noted. For instance, preoperatively the operated right kidney gave an 0.8 per cent urea as compared to 1.1 per cent on the left side. There was good equal indigo carmin from both sides. About four weeks after a wide hemisection of the right kidney, the indigo carmin on both sides was identical, fairly strong, and the urea on the right was 0.6 per cent, and on the left 0.7 per cent. About a month later, a differential phenolsulphonephthalein test was made on both sides, and the right compared to the left as 45 to 65, a strong concentration being present in both sides. Seven months later a further control showed strong indigo carmin from both sides, with urea on the right side markedly less than on the left, but recontrol three months later showed that the phthalein output was strong in six minutes on both sides. The relation of the right to the left was as four is to seven, and the urea on both sides was 1.2 per cent.

This and similar previous experiences throw considerable doubt upon our ability to determine preoperatively whether we are dealing with a hypoplastic kidney or not.

THE SURGERY OF PAIN

WITH SPECIAL REFERENCE TO CERVICAL AND LUMBAR GANGLIONECTOMY*

WILLIAM FRANCIS HONAN, M.D., F.A.C.S. AND SAMUEL ALCOTT THOMPSON, M.D.

NEW YORK

BY reason of the great interest in the study of the sympathetic nervous system and its relation to disease, there is a veritable "surgery of pain." (Leriche.)

The splendid results of surgical intervention in the human body at the present time are largely due to complete and accurate studies in physiology. This is particularly true of the subject we now present, the foundation of which was laid years ago by the observations of Gaskell and the subsequent researches of Langley—those brilliant representatives of the Cambridge School of Physiology.

The type of surgery which it is necessary to employ for the relief of pain is somewhat different from that usually indicated. It is easy to relieve a painful peristalsis, a violent and persistent headache or the tension of an infection. But in the variety we speak of, pain is not the only consideration, nor has it always the advantage of a predetermined topography. Pain of disease finds its expression in the nervous system.

The famous experiments of Claude Bernard, published in 1868, in which he demonstrated the mechanism of the vasomotor control of the caliber of the blood vessels by the sympathetic nervous system, were regarded as interesting experiments in physiology until Jaboulay of Lyons in 1889 applied the principle in the decortication of the femoral artery for the cure of perforating ulcer of the foot. His purpose was to destroy the action of the vasoconstrictor control, producing a dilatation with permanent hyperemia of the part supplied by the decorticated artery. In this he was not very successful, but later his associate, Leriche, with a definite and improved technique which he called periarterial sympathectomy, employed it in a variety of conditions of the extremities, such as trophic neuroses, scleroderma, acroasphyxia, Raynaud's disease, causalgia, varicose ulcers, arteriosclerotic gangrene, painful stumps, and other diseases characterized by pain or instability of the peripheral circulation.

Leriche's enthusiastic contributions to medical literature on this subject aroused great interest and the procedure as described by him was performed extensively in Europe and to a certain extent in this country, particularly after his appearance before the Chicago Surgical Society in 1921. It is said that up to the time of his visit to the United States Leriche was not acquainted with Buerger's disease or thromboangitis obliterans.

We were interested in the report of the case operated upon by the late Dr. Albert E. Halstead of Chicago, in which a most excellent result was obtained in a case of endarteritis obliterans. The patient, a postman, had been obliged to resign his position on account of pain and intermittent claudication involving one foot and leg. In a subsequent report of the case in which Halstead described the operation, he considered, after a period of one year, that the patient was entirely cured since he was able satisfactorily to perform the duties of a position which kept him on his feet for a number of hours daily. Halstead in his report considered endarteritis obliterans and throm-

boangitis obliterans one and the same pathological entity.

Having sufficient clinical material, we performed over two hundred periarterial sympathectomies for a number of conditions due to nerve or circulatory disturbances, or both, with varying results. Most of the patients came to operation

coats, to dilate the arterioles by relieving spasm and thereby increase the circulation to the impoverished extremity, and that little or no relief might be expected in the presence of organic vessel pathology. This did not prove to be the case for we found that some of the very best results were obtained in senile gangrene of the

FIG. 1.
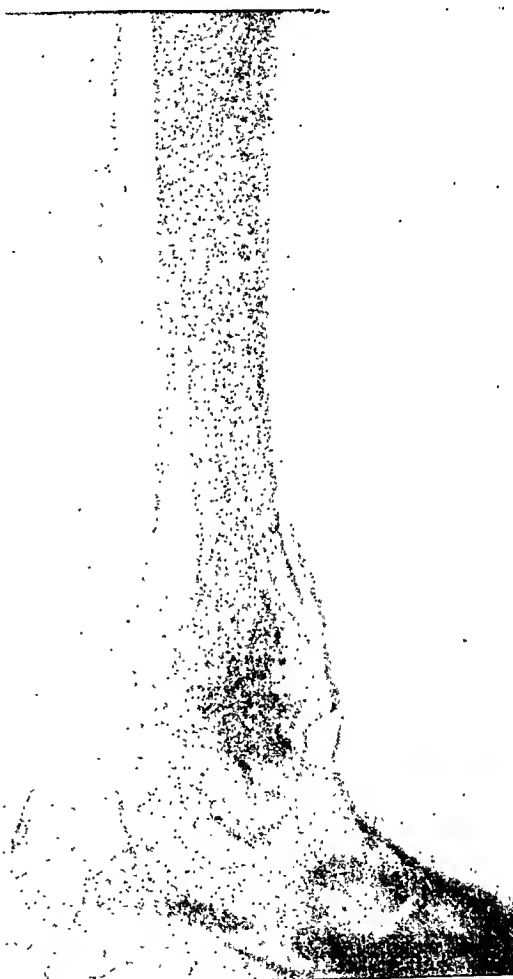
FIG. 2.

FIGS. 1 and 2. Roentgenograms made immediately after injection of 6 c.c. of lipiodol in femoral artery. Anterolateral and lateral views.

for pain, gangrene, ulceration, or a combination of these. During that period our classification was, roughly, endarteritis obliterans or arteriosclerosis, Raynaud's disease, or thromboangitis obliterans. We had been led to believe from the literature at our disposal that the purpose of the decortication was, by severing the sympathetic nerve connection to the arterial

feet in which the femoral artery at operation was in a state of such extensive calcareous degeneration as to show through its coat on the removal of its sheath. Calcareous plaques of various sizes could be seen occupying the entire exposed portion of the vessel. No pulse waves could be detected by either touch or sight. Upon removal of the adventitia,

however, the artery pulsated vigorously so that its effect could be seen from the seats in the operating theater. This effect was remarkably dramatic and particularly so in those cases in which the calcareous degeneration of the vessel was so advanced that if it was wounded, as happened in three instances, it was impossible, decidedly that he had never been able to correlate animal experiments with his clinical results. The vasomotor control of the arteries had always been considered segmental in its distribution. Therefore, how could it be possible to influence the circulation in the foot by a decortication of the femoral artery in Scarpa's
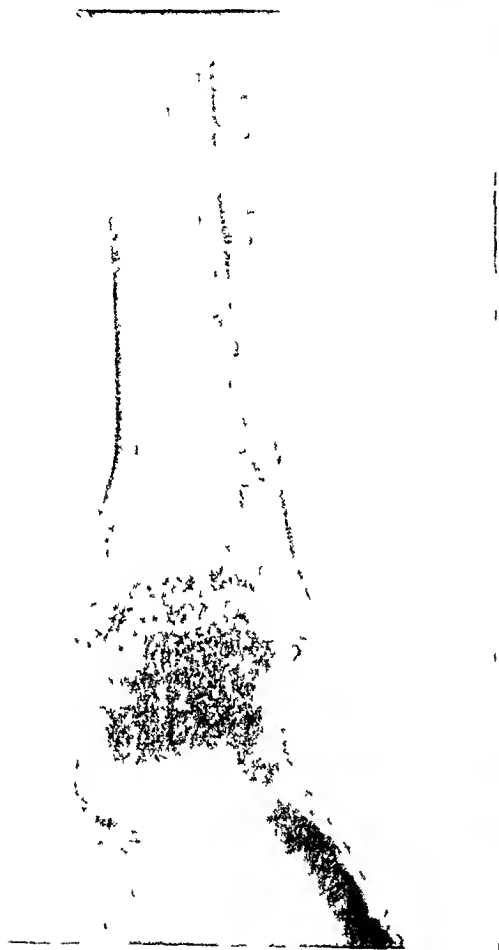
FIG. 3.

FIG. 4.

FIGS. 3 and 4. Roentgenograms made immediately after periarterial sympathetectomy of femoral artery Anterolateral and lateral views.

sible, on account of the friability and chalkiness to pass a fine silk suture for the repair of the opening. It was found, however, that the rather free hemorrhage could easily be controlled by the application of bare muscle tissue arranged so as to produce a sufficient amount of equable pressure over the opening.

At the outset Leriche had stated very space, since there was no evidence of nerve connection between the segmental areas? As a matter of fact, in decortication of the artery an immediate dilatation occurs; this is followed in a few minutes by a contraction which supposedly lasts a few hours to give way to a dilatation which lasts for about two weeks. The contraction occurs only in the decorticated

segment of the artery, it being dilated above and below the denuded area. In favorable cases there will be an increased temperature and hyperemia of the foot corresponding to the operated side. Yet, thus far no demonstrable anatomical studies of nerve distribution have been noted to account for this effect.

in fact, few patients in the wards of the hospital give evidence of a greater degree of suffering than do these. It is astonishing that so little is known of this condition. So thoughtlessly is the pathology estimated that even some physicians expect to see the gangrenous parts restored by periarterial sympathectomy as by a miracle.

Fig. 5. Roentgenogram made immediately after injection of lipiodol in femoral artery. Anterior view.

Fig. 6 Roentgenogram made immediately after periarterial sympathetectomy. Anterior view.

The picture is entirely different in Buerger's disease, for the relief of which we devoted much attention. In this condition there is an occlusive thrombosis of the blood vessels with a migrating phlebitis. Unfortunately the cause, though probably an infection, is not definitely known. Usually when the patients are first seen in out-patient clinics and hospitals, the condition is terminal, without pulse in any artery below the knee and usually with some degree of gangrene in one or more of the toes. The patient has applied for relief of pain and disability; he is unable to walk on account of the pain in the foot and muscles of the calf, causing intermittent claudication. In a short time the pain becomes almost unbearable;

In our early cases of Buerger's disease, many of which had been treated by the introduction of various solutions calculated to diminish the viscosity of the blood, stimulate leucocytosis, relieve pain, etc., we undertook to lower the site of amputation from a point above the knee to the middle of the tibia, and in a few instances periarterial sympathectomy and a guillotine amputation above the gangrenous part relieved pain, apparently increased circulation, and enabled us subsequently to reamputate at a desirable point for the application of a prosthetic apparatus. These cases, however, were too few to justify that technique.

Subsequently our attention was directed to the work of Royle and Hunter in their

contribution to the relief of spastic paralysis. The fact that in their effort to relieve spasticity of muscles in injuries of the brain and spine (as seen more especially resulting from war wounds), it was necessary to discover the opposing elements which produced spasticity and prevented re-education and development of cerebral
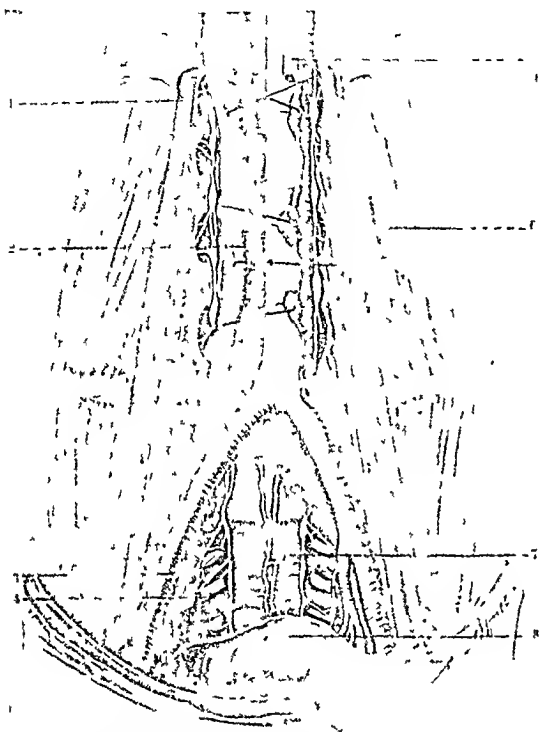
FIG. 7. The lumbosacral chain. Note different situation of lumbar ganglia on right and left sides with relation to the inferior vena cava and the abdominal aorta respectively. 1. Lumber chain at level of first lumbar vertebra. 2. Inferior vena cava. 3. Branch of sacral nerve. 4. Second sacral nerve. 5. Superior mesentery artery. 6. Lymphatic ganglia of latero-aortic chain. 7. Nerve of middle sacral artery. 8. Pelvic colon. (After Bonnait.)

control. Recalling the work of Perroncito in 1901 that each spinal nerve was accompanied by a sympathetic nerve, and after doing a series of animal experiments, they concluded that to relieve spasticity the effects of the sympathetic nerve must be removed. By ramisection of the cervical sympathetic fibers in the neck for spasticity in the upper extremities and division of the rami communicantes in the lumbosacral region for similar

conditions in the lower extremities, it was possible then to re-educate paralyzed patients with remarkable restoration of function. It was also noted that following ramisection there was hyperemia and elevation of surface temperature in the limb corresponding to the operated side, and from the study of their results we decided to attempt the same operation for conditions for which we had previously employed periarterial sympathectomy of the larger arteries of the upper and lower extremities. We made use of the experiences of Knavel and Davis of Chicago, and Adson of Rochester, Minnesota.

Though our experiences have been somewhat limited, the results have been so striking that we believe they open up a field for surgical endeavor in which the results may prove unquestionably brilliant in carefully selected cases. The real criterion of the propriety of employing any surgical procedure is to establish a correct diagnosis and properly to estimate the extent of the pathological process, realizing that when the case is in a terminal stage and the presence of molecular death is obvious, ablation of the offending part must be made in an area sufficiently viable to offer relief from pain, which is a good index to the success of the operation, and to promote normal healing and give satisfactory postoperative function of the limb.

Our first attempt at relieving distress by cervical sympathectomy was in a condition resulting from exposure to cold, with obstruction of circulation in both hands. This patient, a healthy man about forty-two years of age, presented the following history:

CASE I. J. B., admitted February 18, 1927, complaining of frozen fingers of both hands with pain and disability. Several weeks previous to admission patient had both hands exposed to snow and rain while he was unconscious. The fingers became numb and stiff, later swelling and contracting and the nails dropped off. Past personal and family history irrelevant. Occupation, barber.

Physical examination revealed no pathology except of both hands. The fingers of both hands were flexed and swollen and fixed, resembling claw hands. Fingers very tender to touch. Finger nails absent and skin of fingers peeling off in spots. Radial pulsation present in both wrists. Wassermann negative. Diagnosis, frost bite of both hands.

Operation, March 3, 1927. A right cervical ganglionectomy was performed under ether anesthesia. Operative procedure consisted in making an incision extending from angle of right jaw along sternomastoid border to clavicle with a hockey stick prolongation above clavicle to right. Sternomastoid muscle and carotid sheath displaced outward and the sympathetic chain identified. The middle inferior stellate ganglion on right side removed by avulsion. Layer closure of wound.

Progress. Immediate postoperative convalescence good. The second postoperative day he stated that he had less pain in fingers of both hands, more marked in the left, and the function was greatly improved. The fingers and hands continued to improve and three weeks after operation massage and baking had so improved the flexion of the joints that patient was able to pick up small objects with his fingers. Sensation fully returned and patient was discharged April 4, 1927, with about 60 per cent function of both hands.

It was suggested that relief, particularly on the left side, was purely psychic and had no bearing upon the operative procedure, but in opposition to this theory, the bilateral action of removal of the sympathetic ganglia had been previously reported by Leriche. The improvement, however, was very satisfactory, being supplemented by massage and other physical therapy which, following the operation, was well tolerated though previously the slightest touch on the fingers produced an effect not unlike a mild electric shock. Subsequent to the operation there was a slight degree of Horner's syndrome which gradually improved. With some difficulty the patient was persuaded to remain in the hospital for a month in order that he might be kept under observation and treatment. A month later a letter was received from him expressing deep gratitude and stating that he had returned to his work as a barber and considered himself perfectly well.

CASE II.   M. M., a worker in a rubber factory, aged fifty-five and single, was admitted to the Hospital on February 14, 1927, complaining of ulcers on both feet and inability to walk on account of pain and swelling of the feet. His illness began about one year previous to admission, with the development of two small ulcers on the dorsum of the right foot. Soon after the ulcers appeared the great toe of the left foot became infected. He had had varicose veins in both legs for thirty years, with slight swelling of both feet for several years.

FIG. 8. Front and lateral views of neck cervical ganglionectomy for frozen and contracted fingers.

He denied any venereal infection. He had had no diseases of childhood, but remembered malaria twenty-five years previously, and a compound fracture of the right femur fifteen years previously. His family history was negative.

Examination of the head, neck, chest, abdomen, genitals and rectum were essentially negative for pathology. The lower extremities presented a slight degree of varicosity of the superficial veins. Both feet were slightly edematous. The left great toe showed a chronic paronychia. On the plantar surface of the right foot at the base of the great toe was a small punched-out non-purulent, unclean ulcer about the size of a ten-cent piece, with a similar ulcer at the head of the fourth metatarsal, and an inflammatory reaction at the distal end of the second toe. The skin of both feet was much thickened, dry and scaly. The toe nails were thickened and somewhat deformed. Pulsation was present in the anterior tibial, posterior tibial, dorsalis pedis and popliteal arteries, and was equal on both sides. The Wassermann test was negative.

Diagnosis. (1) Polyarthritis of both feet; (2) varicose veins of both legs; (3) trophic ulcers of the right foot.

Operation. A bilateral lumbar ganglionec-

tomy was performed under ether anesthesia on March 3, 1927. The procedure consisted of a midline abdominal incision about three inehes above and three inches below the umbilicus. The intestines were displaced upward and packed off. The incision was through the posterior parietal peritoneum along the lateral border of the abdominal aorta about 4 in. long. The second and third lumbar ganglia on the

the patient had suffered from dyspnea on exertion.

Purely for the purpose of relieving pain a cervical sympathectomy was done on the left side under local anesthesia. The middle inferior cervical ganglia with the cervieal branehes of the stellate were removed also. Relief from pain was prompt and no measures were required for cardiac distress.

FIG. 9. FIG. 10.

FIGS. 9 and 10. Cervical ganglionectomy for angina pectoris.

left side were identified and removed by avulsion. The posterior peritoneum was stripped off from the abdominal vena eava which was displaced slightly to the left, and the portion of the duodenum was identified. The second, third and fourth lumbar ganglia of the right side were identified and removed by avulsion. The posterior peritoneum was closed with interrupted catgut sutures and a layer closure of the anterior abdominal wall was made.

Convalescence was rather stormy but with a gradual reduction of the edema and increased warmth of feet and legs. The trophic ulcers were healed about five weeks after operation, as was also the infection of the left great toe. The patient was discharged as cured, May 3, 1927.

CASE III. T. B., aged forty-five, suffered severely from angina pectoris, often having several attacks in twenty-four hours, with diminishing relief from amyl nitrite and nitroglycerine. His heart was somewhat enlarged. Physical examination by internist did not show any very definite organic lesion, although

Two months later the patient was diseharged from the hospital. The dyspnea had improved and he had not had even a suspieion of angina.

A discussion of the operative procedures for angina pectoris is a very large subject in itself and few surgeons agree on just which ganglia should be removed, to say nothing of the indications for the operation and the extent to which it is justifiable. A single case is no criterion, but our purpose was to relieve severe pain and that object was very definitely accomplished.

Thus began our experiences with cervical and lumbar ganglionectomy and although this is merely a preliminary report of a few cases, we are convinced with Leriche that there exists today a "surgery of pain," and we shall quote extensively from his contributions on the subject.

The object is to afford relief to those who suffer from painful syndromes of

unknown origin, in which pain is the outstanding feature and which ordinary surgery has failed to relieve. Another group of incurable conditions are cancer and tabes which carry with them frightful suffering. When a chronic painful condition is present in a patient of which there is no hope of a spontaneous cure, surgical intervention should immediately be considered.

The disease finds itself expressed in the nervous system. The anatomical direction of pain is complicated by a long course of which nothing is specific. The excitation which is the cause can originate anywhere—at the periphery, at the center or from trivial causes. The topography in which it presents itself does not always show clear indications of its possible origin. Its different expressions do not tell anything of the mechanism of its production. Furthermore, the condition is frequently colored by the psychology of the patient and such a fact has no diagnostic value.

There are two main types of pain, cerebrospinal and that of the sympathetic system. The first follows an expression of classical anatomical topography, always identical, and does not depart from a territory of a given innervation. The area is fixed, without radiation and it cannot at once reach all of the branches of the stricken nerve but if it extends it must do so by the regular and known anatomical distribution. It is not continuous. Without any apparent reason it ceases abruptly and relief is complete until the next attack. Neuralgia of the trigeminal is a characteristic example of this phenomenon.

Pain of the sympathetic system is unstable, less circumscribed and distributed less systematically. It radiates continually into new territories. It may gradually extend and go from side to side. It is aggravated by all of the emotions, aggravated by violent disturbances and noises, and influenced in a degree by atmospheric charges which we do not understand.

Operations undertaken for the relief of pain should not be dangerous to life nor should they expose the patient to the risk of an infirmity.

The operation for trigeminal neuralgia is a triumph of surgical intervention for pain. When the pain is located in the territory of the distribution of the fifth pair, the pain being of an intermittent character and diagnosed as the characteristics of trigeminal neuralgia, section of the postsensory root of the Gasserian ganglion will almost surely cure. Such cure has been abundantly proven since this procedure is one of the older surgical invasions of the sympathetic ganglia, and at the present time represents a satisfactory evolution from Hartley and Krause to Frazier and others. If the pain is continuous, and not limited to the exact distribution of the trigeminal, one usually says the pain is of sympathetic origin and retrogasserian neurotomy is contraindicated, as the procedure always fails.

We have operated for angina pectoris only once and since we have demonstrated the ease with which it can be done, we would strongly recommend the more general employment of this procedure. Given a fairly good myocardium and the employment of local anesthesia, the operation is quite justifiable and leads to most excellent results in prolonging life and usefulness with complete relief of the angina.

The literature of various countries abounds in cases operated upon with varying results, indicating that this operation will be performed more and more.

Theoretically, Raynaud's disease should have been best influenced by periarterial sympathectomy but our results have not been very satisfactory, as our cases were distinctly terminal. This disease appears in many clinical forms, and lack of knowledge of the mechanism of its production in all cases has not permitted exact conclusions. Our cases suffering from the effects of cold seemed to be atypical Raynaud's disease, being bilateral due to peripheral nerve

injuries and attended with trophic changes. They probably came under the classification of what Leriche termed "an ascending neuritis." In a number of instances Leriche and others report lasting cures by bilateral sympathectomy, some of them extending over a period of ten years. Other conditions were found, such as causalgia, a neuritis of the sympathetic nerve following injuries, civil or military. If the disease was not far advanced, periarterial sympathectomy with excision of the cicatrices was generally successful.

The next case illustrates lumbar ganglionectomy in an early case of Buerger's disease.

CASE IV. D. H., aged thirty-four, a Russian by birth who had been in America fifteen years, gave an unimportant family history. About seven years previously he had had the left leg amputated for what would seem, from the history given, to have been Buerger's disease. In February, 1927, he began to have pain in the calf of the right leg, extending to the foot. He was admitted to the Fifth Avenue Hospital, July 2nd, 1927, with typical thromboangitis obliterans, with rubor when in dependent position and syncope on elevation of the leg. The second toe was infected, the nail came off, and ulceration extended upward to the metatarsophalangeal joint. No pulse below the popliteal region.

On July 21, 1927, a right lumbar ganglionectomy was performed and an unusually smooth convalescence followed. The foot and leg became warmer and rubor practically disappeared. The oscillometric index improved, and since his recovery from the anesthetic he has had no further pain or inconvenience to date, March 15th, 1928.

Lumbar ganglionectomy is indicated for abdominal pain following gastric, gallbladder, bile-duct, and liver operations made through possible error in diagnosis and in which the patient is not relieved of pain. It may also be useful in visceral and pelvic neuralgias.

We are quite convinced that the better results following partial gastrectomy rather than gastroenterostomy in pre- and post-pyloric ulcer, may be due in large part not only to the removal of pathological tissue, but to the section of the sympathetic nerve innervation of the pyloric antrum and first portion of the duodenum.

In gynecologic conditions Leriche considers that sympathectomy has made its greatest progress. Section of the presacral nerve will relieve many painful pelvic conditions. It is also highly probable that sympathectomy or ganglionectomy, or both, will ameliorate the pain of inoperable or recurrent carcinoma of the uterus. This will also give opportunity, upon abdominal section, to relieve any other complication, such as obstructed ureter or intestine, and, if successful, will spare the patient a long period of morphinism with its distresses, which close the picture of malignancy.

Oppel, who classified all cases under "spontaneous gangrene," believed it to be the local expression of a hyperadrenalinemia, an arteriosis suprarenalis of the extremities, producing desquamation of the endothelium, degeneration of the muscular coat with thrombosis. He and his assistant seemed to demonstrate that the gangrenes had an excess of adrenalin in the blood serum which produced spasm of the arterioles, and that also hyperglycemia was present. Furthermore, there was a hyperthrombocytosis, a tendency to hyperglobinuria, increased viscosity of the blood with final coagulation.

For this condition he performed left suprarenalectomy in about 115 cases, leaving a small bit of the gland in situ. After operation he reports a fall in the systolic and diastolic blood pressures but a rise in the peripheral pressure of patients due to pressure. The blood pressure remained low and is not to be explained by the effect of the anesthesia or shock. The blood sugar became normal and there was a fall in the thrombocytes. He described other proteid animines which are also vasoconstrictors. Basedow's and Addison's diseases showed normal adrenalin in the blood but it was definitely increased in Reynaud's disease. Oppel's work

attracted much attention but a study of the final result of a large number of surrenalectomies done in Russia and elsewhere showed that most of the cases had come to amputation, and those supposedly cured were almost negligible. This is most unfortunate for the hypothesis seemed tenable and the operation fairly safe.

Angina pectoris offers a very interesting field for sympathetic nerve surgery but presents some difficulties at present because of the lack of unanimity on the part of surgeons as to just which nerves should be ablated and what type of disease is amenable to operation. The stellate ganglion, which is a fusion of the branches of the inferior cervical ganglion and the first dorsal of the sympathetic, is the great central station of the aorta and heart innervation, but its bilateral removal, as has been recommended, is associated with danger of pulmonary edema and other complications.

The removal of the superior ganglion, practiced by Jonnesco and later by Coffey and Brien, is not thought necessary by Leriche, Danielopolu and others. We have achieved results in two cases without its removal, and confine ourselves to ablating the so-called sensory fibres which are connected with the middle inferior and stellate ganglia. The best cardiologists differentiate between angina pectoris and coronary thrombosis, and we suggest operative relief for the condition, described by Albutt and later emphasized by Alexander Lambert, of a substernal lancinating, more or less radiating, pain, in contradistinction to the epigastric pain of coronary thrombosis often mistaken and operated upon for gastric ulcer.

To relieve the pain of coronary thrombosis by surgery is comparable to the attempt to relieve Buerger's disease with gangrene in a similar way. The comparison may be crude; both present advanced arterial disease with occlusive thrombosis, the former with an ischemic heart muscle and the latter with gangrene—both ter-minal expressions of perhaps a similar pathology.

In order to determine what actually occurs after femoral sympathectomy, we exposed the femoral artery in Scarpa's triangle and injected 6 c.c. of lipiodol into the lumen of the vessel. Slight traction was made upon the artery and roentgen-ray exposures were made in the region of the knee, the leg, and the foot. A sympathectomy was then performed on the femoral artery and an immediate series of roentgen-ray exposures was made of exactly the same regions with the leg in the same position. The results are shown in Figures 1, 2, 3, 4, 5, 6, 7. These exposures must be made immediately, as contraction occurs within a short period after decortication.

If a quick guillotine amputation is made, there will be a slight oozing from the soft tissues but by the time the sympathectomy is complete one is obliged, in favorable cases, to ligate two to four spurting arteries in the leg. Most of our observations have been made upon the lower extremities, using the femoral artery, though approximately the same results are seen in the upper limbs. While we have met with many failures in decortication of the brachial artery, the operations being frequently undertaken in cases in which there was scarcely any hope of relief due to the advanced state of the disease, no harm apparently was done as the fatalities were only in cases of late diabetic gangrene. We feel justified in continuing our efforts, particularly in cases suitable for cervical or lumbar ganglionectomy.

DISCUSSION

Dr. Leo Buerger. Drs. Honan and Thompson have made it very clear that they are doing these operations for that disconcerting symptom of the disease, pain. Some of these procedures have fallen into disrepute because of the exaggerated conclusions reached as to their influence on the disease *per se*, whereas Drs. Honan and Thompson have been careful

to adjudge their restrictions as well as their benefits. For years I have pointed out that in circulatory disturbances of the extremities this phenomenon of pain is not produced by any one single factor but by a number of forces. One of these was alluded to in the reference to the importance of removing gangrenous parts. Indeed, ulcers, trophic disturbances, gangrenous areas may be directly responsible for severe pain. But there are other types of pain whose paths reside in the sympathetic nervous system and some of these we can hope to alleviate.

We are dealing with a complicated nervous and arterial mechanism in which not only the large and small arteries but also collateral circulation play a role. Vasomotor innervation may be disturbed not only by fibrosclerotic changes in the nerves accompanying the arteries but also to reflexes. We can hope for some alleviation of symptoms by interference with the vegetative nervous paths in an anatomic way. Further proof of this possibility is to be found in the fact that if we interfere with the vegetative nervous system by operation we get changes in the surface temperature. Indeed, even in organic disease of the vessels, this vasomotor mechanism may be disturbed and we may observe vasomotor constriction over certain areas of the foot independent of the obturation of the larger arteries, and it is this malfunction that may be improved through the operation suggested. Often the surface temperature is improved thereby, which may explain some of the remarkable effects Dr. Honan and Dr. Thompson have obtained.

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THE VICTOR EMMANUEL III NATIONAL INSTITUTE FOR THE STUDY AND TREATMENT OF CANCER, MILAN, ITALY*

Gaetano Fichera, m.d.

MILAN

FOR some time there has been a need in Italy for an organized national warfare against cancer such as has been carried on in other progressive nations. Previous attempts to bring about an organization of this kind had been made by a committee headed by Senator Golgi, who enlisted the cooperation of Senator subscribed, including the contributions of the city of Milan, the Savings Bank, the Commercial Bank, the Sierotherapeutic Institute of Milan and the Italian colony of Sao Paolo, Brazil. In the spring of 1925 the King inaugurated the construction and in less than two years the work was finished. The plans were drawn by Mr.
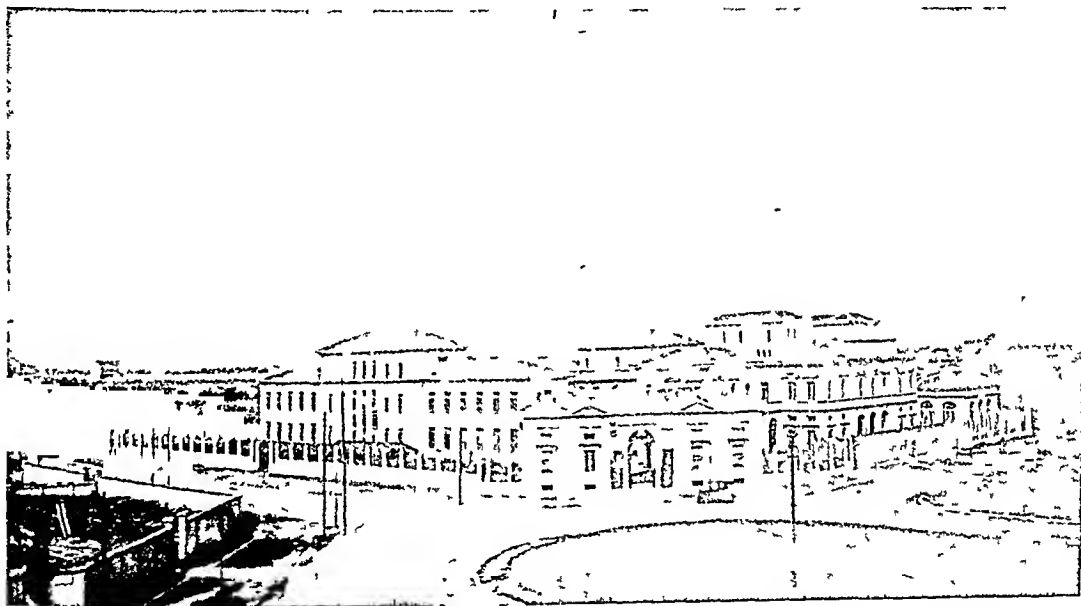
Fig. 1. Victor Emmanuel iii National Institute for Cancer, Milan. General view, July, 1927.

Lustig and Mr. Frisoni, as well as that of the Red Cross and the National League against Cancer. But the happy decision to build what is today the most conspicuous and complete institution of its kind in the world resulted from the work of Professor Luigi Mangiagalli who, as Mayor of Milan, started an appeal for such a foundation. Wishing to honor the King on the twenty-fifth anniversary of his reign, he named this foundation L'Istituto Nazionale Vittorio Emanuele iii.

In a few months ten million lire were Monticelli and the buildings were constructed under the direction of Mr. Ferrini, the engineer.

The six buildings cover a space of 12,000 square meters and are connected by underground passages and galleries. In the structure facing Via Strambio are found the president's office, the administration offices, rooms of the physicians, the library, the statistical department, the pathological section, the biochemical experimental laboratories and the office of the periodical, *Tumor*. The pathological section is under
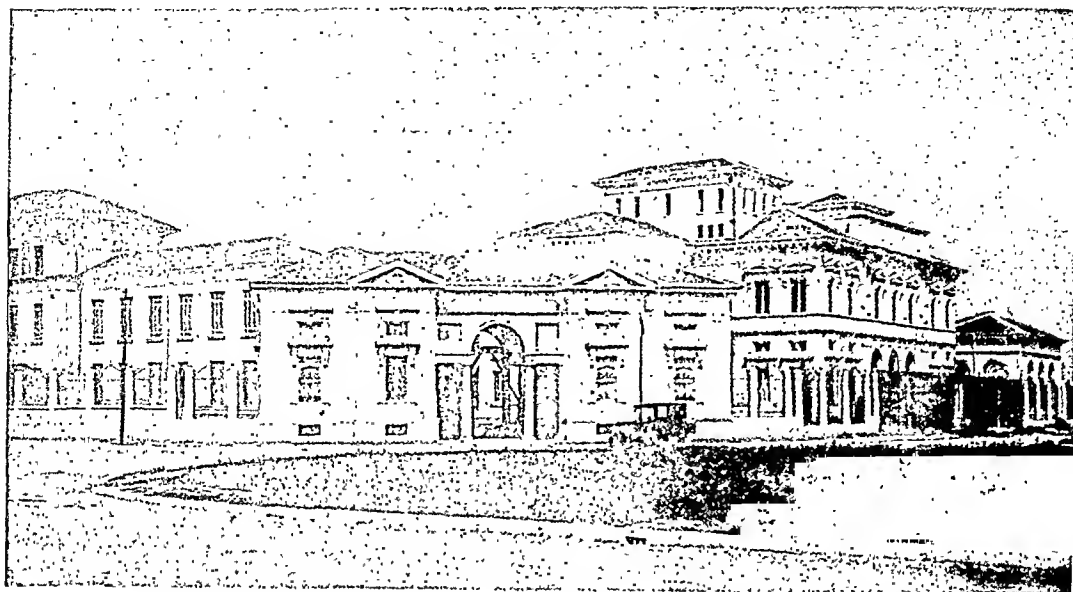
FIG. 2. Central Service Entrance. Administrative offices and laboratories.
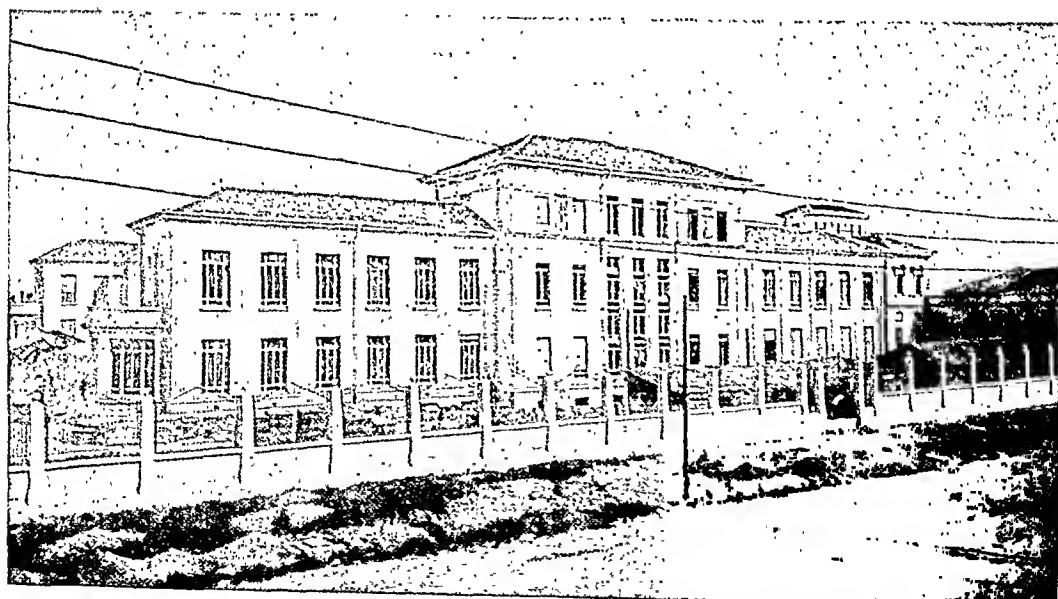
FIG. 3. Men's building.
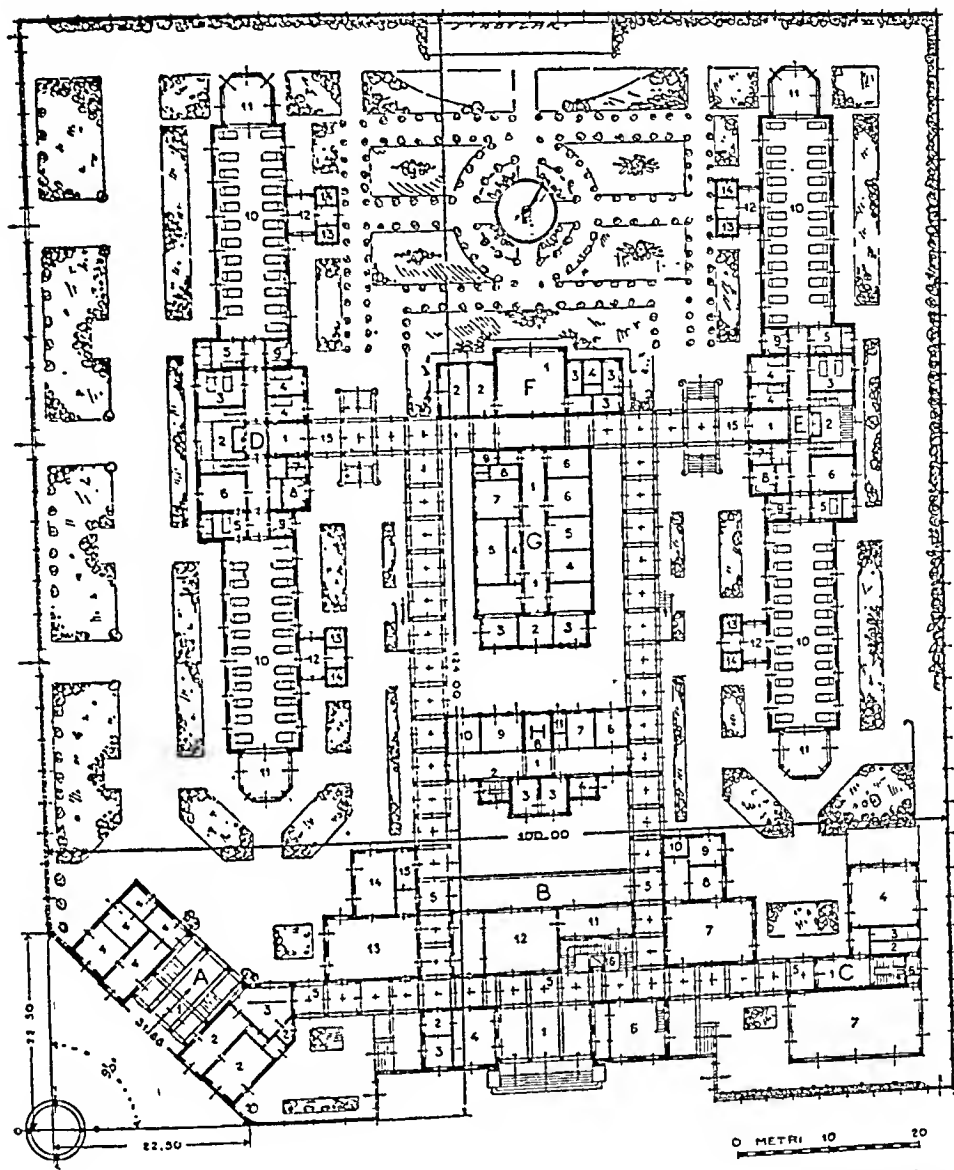
Fig. 4. Plan of the lower floor. A. Gate. 1. Entrance. 2. Concierge. 3. Visitor's room. 4. Service and chaplain. 5. Gallery.

B. Administration Rooms and Laboratories. 1. Principal entrance. 2, 3, 4. Physician on duty. 5. Galleries. 6. Council hall. 7. Waiting room and anatomical museum. 8, 9, 10. Director's room and anatomical section. 11. President's waiting room. 12. Office of the president. 13. Visitor's room. 14. Medical examinations. 15. Service. 16. Stair to basement, with kitchen, pantry and storeroom.

C. Autopsy and Conference Hall. 1. Entrance. 2, 3. Laboratories. 4. Autopsy room. 5. Gallery. 6. Passage and stair to basement. 7. Conference hall. In the basement, deposit for cadavers, microphotograph room.

D. Infirmary for Men. 1. Entrance. 2. Stair to basement. 3. Rooms of paying patients. 4. Pharmacy. 5. Nurse on duty. 6. Storeroom. 7, 8, 9. Bath. 10. Nurses. 11. Veranda. 12, 13. Lavatory. 14. Refuse. 15. Galleries.

E. Infirmary for Women, same as for men.

F. Building for Surgery. 1. Operating room. 2. Room for preparation of patients, armamentarium. 3. Room for surgeon. 4. Service.

G. Institute of Radiology. 1. Gallery. 2. Elevator. 3. Radiumtherapy room. 4. Director's room. 5. Machinery. 6. Waiting room and office. 7. Research laboratory. 8. Lavatory. 9. Dark room.

H. Building for Radiumtherapy. 1. Corridor. 2. Stair to basement. 3. Emanation tubes. 4. Waiting room. 5. Gallery, office. 7. Instrument room. 8. Preparation of radium apparatus. 9. Radium application. 10. Preparation of patients. 11. Lavatories and basement.
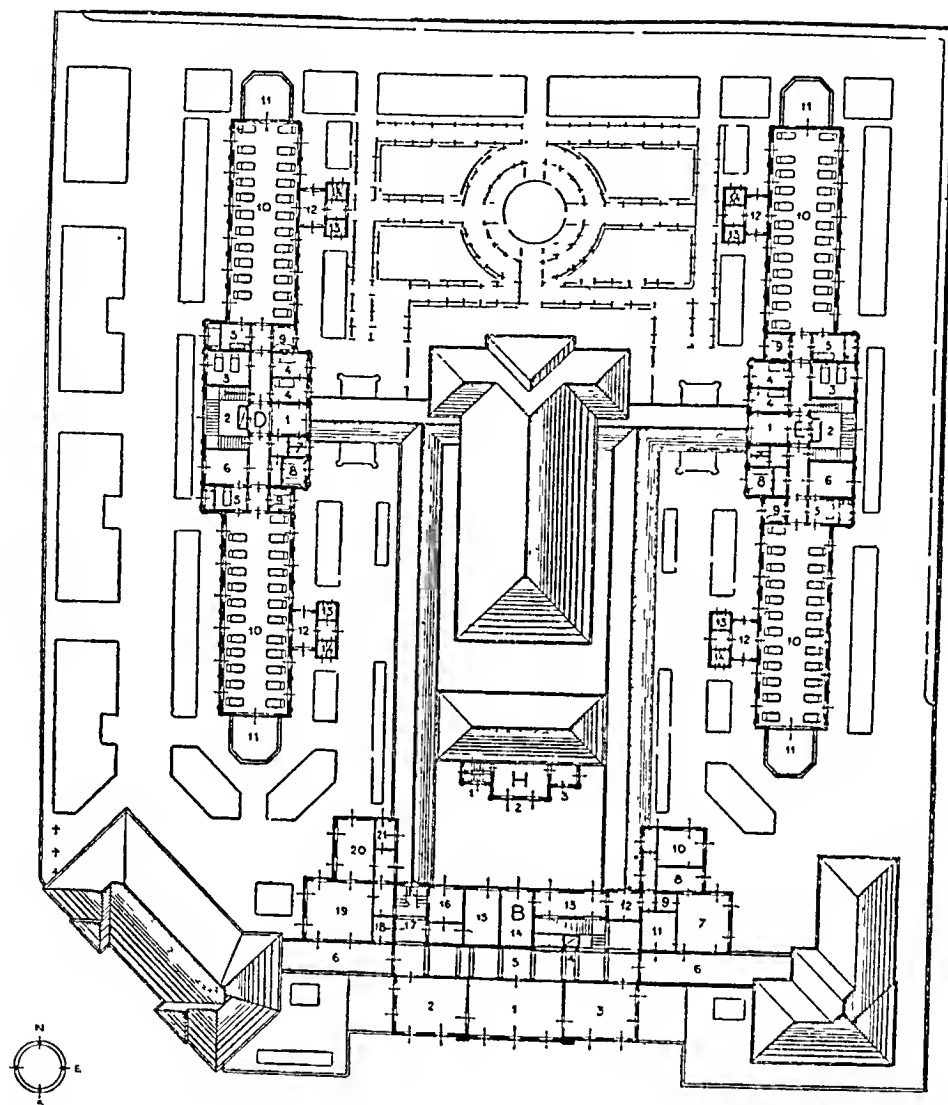
FIG. 5. Plan of the upper floor. A. Administration Rooms and Laboratories. 1. Library. 2. Director's laboratory. 3. Director's room. 4. Stair. 5. Gallery. 6. Veranda. Experimental biological section. 7. Laboratory. 8. Dark room. 9. Thermostat. 10. Assistant. 11. Director, biological section. 12. Waiting room. 13. Instrument and motor room. 14. Preparation room. 15. Laboratory. 16. Lavatory. 17. Stair to 2nd and 3d floors. 18. Scales. 19, 20. Chemical laboratory. 21. Lavatory.

D. Infirmary for men. 1. Entrance. 2. Stair. 3, 4. Rooms for nurses. 5. Nurse on duty. 6. Storeroom. 7. Lavatory. 8. Bath. 9. Writing room. 10. Nursery. 11. Veranda. 12, 13. Lavatory. 14. Refuse. 15. Gallery.

E. Women's Infirmary, same as for men.

G. Institute of Radiology. 1. Gallery. 2. Service stairs. 3. Room for diagnosis. 4. Visitors. 5. Archives. 6. Directors of the Institute of Radiology. 7. Photography, dark room, kitchenette. 8, 9. Stairs.

H. Pavillion of Radiumtherapy. 1. Stairs. 2. Emanation room. 3. Service.

the direction of Professor Pepere, and the biochemical experimental laboratories under that of Professor Rondoni.

The other large buildings are given over to various purposes. There is a free hospital of eight wards, each containing two hundred beds for poor patients, and another section of fifty rooms for paying patients. The gynecological department includes the tumor-treatment section in connection with the obstetrical clinic, which is under the direction of Professor Alfieri. These various sections, as well as that of statistics, are under the supervision of Professor Fichera, Director General of the Institute and Editor of *Tumor*, the official publication of the foundation.

Between the two pavilions are three minor buildings housing the radium and roentgen-ray departments. These are under the care of Professor Perussia, holder of the chair of radiology at the University of Milan. Here also are found rooms for surgical preparation, sterilization, minor operations and medications, the pharmacy, chapel, and the various service departments. The entire institution is equipped with the most modern apparatus of medical science.

The nation owes its thanks to Professor Mangiagalli whose initiative and enthusiasm brought into being this most humane and valuable institution.

CARCINOMA OF THE BLADDER SECONDARY TO ARTIFICIAL CYSTITIS

CALCULUS PYELONEPHROSIS; NEPHRECTOMY AND TOTAL CYSTECTOMY

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NEW YORK

M. W., male, forty-four years of age. In 1911 the patient was first seen by me, and was suffering from a chronic cystitis with contracted bladder. At this time he gave a history that to escape military service his cystitis had been induced. After some treatment at Mount Sinai Hospital in 1911 the symptoms cleared up and the patient improved.

In 1917 he began having symptoms in his right kidney region, pain radiating to the bladder, frequency of urination, and hematuria. Since three months these symptoms had become worse, and he had lost 25 pounds. A roentgenogram taken showed the right kidney occupied by a large stone, and the patient was sent to Mount Sinai Hospital in June, 1927. At Mount Sinai he was cystoscoped and carcinoma of the bladder and a right pyonephrosis were found. In view of the purulent discharge from this kidney, it was deemed advisable to remove the kidney first, and subsequently take care of the bladder neoplasm.

In August, 1927, the kidney was removed by Dr. Hyman. After recuperating from this operation, the patient returned to Mount Sinai Hospital, and a cystoscopic examination on October 18th, 1927, showed the bladder full of foul bloody urine with numerous clots. The capacity was 8 ounces, and there was an extensive growth on the posterior and right and left lateral walls. The cystogram showed an almost normal shaped bladder, except for the fact that the inferior left circumference showed the bladder walls to be slightly raised. By rectum it was possible to detect a hard, infiltrated mass occupying the whole bladder region. In view of the extensive growth which reached apparently well down to the neck of the bladder, the patient was told that he would probably require a total cystectomy, to which he consented.

On October 21st, 1927, the bladder was exposed extraperitoneally and found to be extensively involved, the walls infiltrated well down over the prostate, and as it was seen through the open bladder that it was impossible to remove the growth except by a total cystectomy and prostatectomy, the bladder cavity was gently packed with gauze and an extraperitoneal excision of the bladder done, with the upper two-thirds of the prostate and the seminal vesicle, as well as the lower end of the right ureter (from the point that Dr. Hyman had cut across it at the nephrectomy). The left ureter was then brought out through a gridiron incision in the left iliac fossa. The wound was soaked in alcohol, and the ureter was intubated with a catheter.

After several days through the median suprapubic incision a large number of radium seeds were introduced into the stump of the prostate with the object of destroying any tumor cells that might have been left behind. The patient made an uneventful recovery.

ENLARGEMENT OF THE BREASTS AFTER PROSTATECTOMY*

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NEW YORK

DURING January, 1927, J. T., seventy years old, Russian born, had a two stage prostatectomy. At that time no enlargement of the breasts was noted on physical examination. On November 2, 1927, he returned complaining of his breasts enlarging, the right more than the left. He noticed this three weeks ago because his suspenders were causing irritation by bearing pressure on the breasts, giving more of a sense of uneasiness than actual pain. He stated that the increase in size was gradual and that lately he had to discard his suspenders for a belt for comfort's sake.

On examination, the patient is seen to be an old man of rather slight build, showing the usual physical characteristics of senility, atrophied skin, pigmentation, white hair and beard, etc. The external genitalia are apparently normal. The Wassermann reaction is negative.

The right breast is uniformally enlarged, protruding about 6 cm. from the chest wall with a normal male nipple from which no fluid can be expressed. On lifting the breast there can be felt an increase in the amount of glandular tissue but no cyst formation. The enlargement is equal in all quadrants, of firm consistency and no isolated distinct masses can be made out. There is no redness or heat and only a moderate amount of tenderness. On rolling the breast under the hand, it is felt to be moderately firm, not fixed nor indurated and no mass is palpable. Some small, firm, freely movable glands can be felt in the axilla. The left breast presents the same picture but is smaller.

Kondoleon[1] reports two cases occurring in men, both seventy years old. The first developed a swelling of the right breast the size of a walnut one month after prostatectomy and after one year it had entirely disappeared. In the second case, the enlargement was noticed in the right breast three months, and in the left four months after prostatectomy. The swelling receded on the right side in this case.

Oppenheimer[2] reports two cases of breast enlargement in men. The first was in a man of sixty-four following prostatectomy. He was of the muscular male type and noticed enlargement of his breasts three months after operation. The right protruded 9.2 cm. and the left 8 cm. from the chest wall, and on picking up the breast an increase of breast tissue could be made out but not by rolling under the hand. He fails to describe the breasts in further detail but states that the external genitalia were normal.

The second case was a man of forty-eight, also of the muscular male type who had his breasts enlarge some months after sphincterotomy for contracture of the neck of the bladder.

In attempting to explain the etiology of this condition, which he terms "gynaecomastia following prostatectomy," he states that gynaecomastia comes on after a change of the male hormone, especially after castration or atrophy of the testes. He cites Monaschkin[3] who saw this occurring with tumor where greater part of the normal testicular tissue was destroyed. All these men were of a feminine physical type, whereas both of Oppenheimer's were of marked muscular male status.

He points out that so-called prostatectomy is not an extirpation of the gland but generally an enucleation of the tumor mass, the prostatic tissue being left behind with a capsule according to Tandler and Zuckerkandl,[4] Marion[5] and others. The prostate is therefore not destroyed but rather given a chance to recover its function after the tumor is removed. On the other hand the manipulation during enucleation and packing may injure the prostatic tissue outside of the tumor mass. In his cases the adenoma was easily shelled out in the first instance and in the second only muscular tissue was removed.

He states that sexual function after prostatectomy is not necessarily disturbed, quoting Joseph[6] who says that such men after operation have normal sexual function for their age and that coitus is possible and that they have spermatozoa in their urine. Therefore the

normal sex hormone is evidently still present, but what role the prostate or its internal secretion, if it has one, plays, is hard to say.

As to proof that the prostate has an internal secretion, and if so how it would cause the breasts to grow or whether or not the lack of such an endocrine in the male would do this, no proof is forthcoming.

There have been investigations to determine whether or not the prostate has an internal secretion. Senalach and Pares[7] found that after total extirpation of the prostate in animals that contraction of the ejaculatory ducts and secretion of the preputial glands ceased. Posner and Kohn and Biedl[7] found intravenous injections of watery and glycerine extracts of the prostate to be very toxic. Haberern says that after extirpation in animals function of the other genitalia ceased. Waldeyer[8] believes that if we ascribe an internal secretion to the prostate that the seminal vesicles also must have one. Bachrach[9] agrees with this. Oppenheimer[2] is of the opinion that the prostate has an internal secretion.

Granting then, that the prostate may have an internal secretion, it is impossible to say what influence the presence or the lack of it has on the growth of the breast, especially in an old man after prostatectomy.

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CONGENITAL MALFORMATIONS OF THE FEET

REPORT OF A CASE OF CONGENITAL FUSION OF THE SCAPHOID WITH THE ASTRAGALUS AND COMPLETE ABSENCE OF ONE TOE

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ABNORMALITIES of the feet are comparatively rare. Only two cases of congenital fusion of the astragalus with the navicular are reported in the literature. Holland[1] reports one case of multiple fusion of the bones of the foot in a girl twenty-one years of age. The astragalus is completely fused with the scaphoid, but shows in the upper part an indication of demarcation; no absence of toes. Esau[2] in 1926 reported a case where fusion of the astragalus with the navicular and first cuneiform is noted. Two toes were absent on the right foot and one on the left foot with no fusion on the left foot.

The rarity of the condition and further light it may bring on congenital malformations are the reasons for describing the following case, which was observed by chance during a routine examination.

CASE REPORT

M. S., male, student, aged seventeen. Always well. Parents, grandparents, one brother and one sister all normal. Patient's left foot normal. Tires more easily on the right foot. The right foot has only four toes and is narrower than the left.

Measurements: right 24 cm. long, 6 cm. wide and 20 cm. in circumference. Arch good. Left foot 26 cm. long, 8 cm. wide and 22 cm. in

circumference. Flat foot. One digit completely absent on the right foot. No evidence of undeveloped toe.

The roentgenograms show that the fifth metatarsal and phalanges are absent. Only one metarsal articulates with the distal piece of bone on the inner aspect of the astragalus.

From the appearance of the roentgenograms the writer is of the opinion that the fifth toe is the one that is missing. The scaphoid is apparently fused with the

FIG. 1.   FIG. 2.   FIG. 3.

FIG. 1. Dorso-plantar view of the right foot shows: (a) absence of the fifth toe, (b) apparent absence of the navicular bone, (c) an enlarged head and neck of the astragalus with a bulging to the inner aspect of the foot, (d) a shadow of a different density on the outer aspect of the head of the astragalus (an encapsulated piece of bone?) and (e) the cuboid articulates with one metatarsal bone and in appearance differs from the normal cuboid in size and shape.

FIG. 2. Dorsoplantar view of the left normal foot.

FIG. 3. Dorsoplantar view of the normal foot. Printed on the wrong side for the purpose of comparing the measurements of the various bones with the corresponding bones of the right foot.

surface of the cuboid. The scaphoid as a separate bone is absent, but the astragalus is unduly protruding and articulates directly with the cuneiform bones. The lateral view shows a roughening and thickening of the head of the astragalus. The dorsoventral view shows an encapsulated astragalus. The internal cuneiforms on both feet are similar in size and appearance; the same applies to the inner four metatarsals on the left foot and the corresponding four metatarsals of the right foot. The difference in length of the two feet corresponds to the width of the navi-

cular of the normal foot, and is a point in favor of complete absence of the navicular bone.

Roentgenological examinations of the rest of the body show no skeletal malformations.

any abnormality for three generations. As in Esau's case[2] the malformation attacked a male, whereas in general it is usually the female that is affected. The malformation in the author's case is unilateral. Usually it is bilateral, although it does not affect

FIG. 4. Lateral view of the right foot shows an abnormally long neck of the astragalus with an irregular line of demarcation at its distal end.

The causes of congenital abnormalities of the foot are not well known. Like other congenital abnormalities they have been attributed to a hereditary predisposition. The case described above does not show any hereditary factor. The immediate members of the family show no skeletal abnormalities. Neither can they trace

both sides equally. The abnormality does not inflict any disability upon the foot.

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LYMPHOSARCOMA OF THE SIGMOID

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LYMPHOSARCOMA of the intestine is a rare condition. According to Rankin,[1] approximately three hundred cases have been reported. The growth

may occur at any point from the stomach to the rectum but shows a marked predilection for the ileum. With regard to the colon, lymphosarcoma resembles carci-

noma in that the most frequent location is in the rectum.

Ewing[2] describes the earliest stage of the disease as a localized thickening of the submucosa with or without ulceration. From this point the growth spreads laterally

medium mononuclears with a liberal amount of cytoplasm, lying irregularly in a meshwork of fine fibrils. Surrounding the tumor cells there may be fragile blood vessels and many small lymphocytes. Clinically lymphosarcoma of the intes-

Fig. 1. Showing barium enema before evacuation with evident obstruction at the end of the descending colon.

Fig. 2. The stomach is pushed to the extreme right by an enormously distended distal colon, patient in vertical position.

invading and destroying the muscular layers and appearing as a subserous tumor. Adhesions form, after which process the central ulceration excavates the tissue. It may produce an aneurysmal dilatation which with peripheral growth yields a large tumor with a roomy cavity. Pronounced stenosis is of rare occurrence. According to Dr. L. F. Barker,[3] "Sarcoma, except in the rectum, does not cause obstruction but rather dilatation of the lumen of the intestine." Chronic peritonitis and chylous ascites are frequently observed in the course of intestinal lymphosarcoma.

Libman[4] states that metastases appear early in the regional lymph nodes and may extend to many of the organs. The cytology of the tumor is that of a small or large round-cell lymphosarcoma. Ewing describes the cells as being large or

tine is most common between the years of ten and forty. The disease usually runs a rapid course terminating fatally in a few weeks or months. Rarely is the condition recognized prior to operation or necropsy. The early symptoms are indefinite; furthermore, the condition is so rare that the examiner is not likely to give it serious consideration. The disease may run an extremely acute course and be ushered in by symptoms resembling those of acute appendicitis. On the other hand, anemia, cachexia and progressive weakness may be the predominant manifestations. Lymphosarcoma of the intestine may be suspected but not diagnosed when characteristic roentgenologic findings are obtained.

Unlike carcinoma, lymphosarcoma may grow rapidly to enormous size. This is an important distinguishing point. Since

intestinal sarcomata may attain large size without giving rise to obstruction, a quiet symptomatology may help to differentiate carcinomata; however, some cases of sarcoma give rise to rapidly developing cachexia, ascites and metastases. When intestinal obstruction occurs—but this is not the rule—vomiting and obstipation are to be expected.

As Kalbfleisch[5] has shown, the diagnosis of intestinal obstruction may be made

FIG. 3. Showing the stomach with patient in prone position.

by roentgen-ray examination. Distended intestinal loops filled with gas and fluid are suggestive of intestinal obstruction and the diagnosis is confirmed by the appearance of fluid levels in the intestinal loops. The fluid level may be demonstrated by placing the patient in the upright position. When the clinical picture suggests intestinal obstruction, the use of a contrast medium is unnecessary as the distended intestinal loops with demonstrable fluid levels are sufficient evidence.

The prognosis of intestinal lymphosarcoma is bad and treatment is highly unsatisfactory. Surgery seems to offer the only hope of either cure or palliation. Some observers, however, have been encouraged by the results obtained with radium. If the lesion is not too extensive, an attempt should be made to extirpate it; otherwise, a sidetracking operation on

the intestinal canal is the most that can be accomplished.

CASE REPORT

L. F., a printer, aged twenty-three, single, complained of nausea, anorexia, weakness and loss of weight of six weeks' duration. The family and previous personal history were negative. The illness began following an indiscretion of diet and had the features of an acute gastritis. In addition to the symptoms already mentioned, there was occasional vomiting and

FIG. 4. Six-hour observation showing the fluid level in the end of the descending colon, with patient in upright position. Proximal to the obstruction, the colon is seen to be enormously distended with gas.

slight chills and fever were observed at times throughout the illness. Although bowel movements took place, the feces were of a scybalous consistency, frank and occult blood negative.

The patient was fairly well nourished. He had marked dental sepsis and traumatic nasal obstruction. Examination of the abdomen showed a certain amount of clapotage and marked borborygmus. No abdominal masses were palpated and tenderness was not elicited.

Three days later he still complained of pain, particularly in the left lower quadrant, and the abdomen was considerably distended. There was board-like rigidity over the seat of the pain. By gentle pressure it was possible to displace the gas noisily from one intestinal

segment to another. This maneuver relieved the pain.

Out of consideration for the associated fever, it was necessary to rule out an acute infectious disease involving the intestine, particularly typhoid fever. The Widal and diazo reactions were negative. The white blood cell count was 12,000; the differential, normal. The erythrocyte count was 4,450,000, the red blood cells showing a normal morphology.

Combined fluoroscopy and roentgenography of the colon by barium suspension enema

Fig. 5. The sigmoid, cut open to show the constriction.

showed complete obstruction in the neighborhood of the splenic flexure. The barium meal showed the stomach to be pushed to the extreme right by the markedly distended distal portion of the transverse colon. A diagnosis of intestinal obstruction was evident, whatever the cause, and immediate operation was considered imperative.

The following is an abstract from a very detailed report received from the New York Hospital.

Operation. The abdomen was opened through a right rectus incision. The intestines were found to be greatly distended. The cecum and appendix were bound down in the pelvis by recent adhesions. On the left side of the abdomen, a white, semi-cartilaginous neoplastic mass was found constricting the lumen of the sigmoid. No enlarged lymph nodes were seen. The mass was delivered with a loop of colon through a second incision on the left side of the

abdomen. Cecostomy was performed and the appendix removed.

The patient did well for a time after the operation and the cecostomy relieved the intestinal obstruction but, on the evening of the first day succeeding the operation, he suddenly changed for the worse and went rapidly down hill, developing the typical syndrome of general peritonitis and died a few hours later.

Postmortem Examination. Permission for postmortem examination was restricted to the surgical wounds. When the right rectus incision

Fig. 6. The ileocecal region, to show the lymphadenopathy.

was opened, the peritoneum was found to be covered everywhere with a thin, brownish-yellow, foul-smelling fluid. Soft sheets of green fibrin were seen on many surfaces of bowel and peritoneum. They washed off easily except along the ascending colon, where they were adherent and left a red, roughened surface behind. In the latter region the peritonitis was assumed to be of longer duration. Above the tumor the intestine was dilated to several times its normal diameter. In spite of this dilatation the wall of the colon and lower half of the ileum were greatly thickened. Yet the wall did not feel nodular in any respect, although the folds of mucosa were enlarged sufficiently to give an aspect of corrugation. The intestine was opened throughout its length and the barium sediment removed from the cecum. The appendiceal stump appeared sealed and the cecum was redundant. The mucosa of the bowel was intensely congested.

Several circumscribed nodules resembling enlarged lymph nodes were found in the mesentery. They felt soft and elastic and on section appeared pale, pink and fleshy, resembling granulation tissue. These masses were all

subserous. A frozen section was made of one of the nodules which showed the histologic picture of lymphosarcoma. Similar nodules were found scattered along the colon to a point several inches distal of the sigmoid tumor, but none was so large as those of the cecum, and the transverse colon was entirely free of them. The bowel distal to the tumor was of normal size. The stomach and upper intestine showed only dilatation.

Histologic Examination. The wall of the intestine above the tumor was found to be

culosis could be eliminated, especially since roentgenologic examination of the chest showed no evidence of tuberculous foci.

A much more difficult condition to distinguish from intestinal lymphosarcoma is pseudoleukemia intestinalis. The Kundrat type of lymphosarcoma which rapidly extends to adjacent glands but shows no tendency to invade neighboring organs closely resembles pseudoleukemia intestinalis which condition develops simultaneously in many lymph follicles. Even when the lesion is inspected at

FIG. 7. Cytology of the neoplasm, showing round cell infiltration.
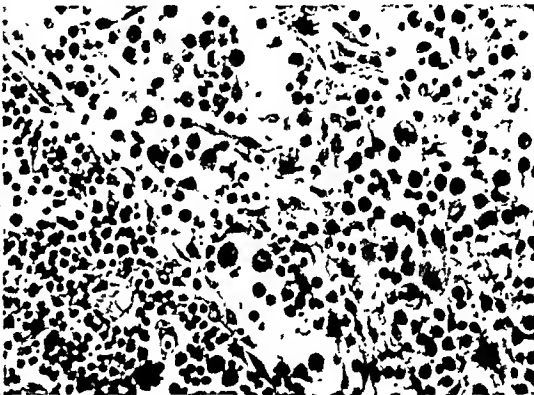
FIG. 8. Same as Fig. 7, another field.

greatly thickened, being three or four times the normal. The mucosa was intact. There were many plasma cells in the stroma and the endothelial elements lining the small lymph vessels contained a brown pigment. One small nodule lay under the mucosa. It was composed chiefly of small lymphocytes, several large lymphocytes and some reticulum. The bowel at the seat of the tumor showed cytologic changes similar to those of the lymph node. These changes were diffuse and involved the subserous and submucous spaces and the mucosa. The musculature of the intestinal wall was partly fibrosed.

Pathologic Diagnosis. Lymphosarcoma of the colon.

DISCUSSION

The preoperative possibilities as to the cause of the obstruction in this case included (1) volvulus, (2) intussusception, (3) peritoneal tuberculosis, (4) pseudoleukemia intestinalis and (5) a neoplasm, either benign or malignant, particularly carcinoma or lymphosarcoma.

Although the presence of fever would appear to suggest such a condition, peritoneal tuber-

operation or necropsy, the differentiation is difficult without microscopic examination.

The peritonitis in this case was probably a neoplastic peritonitis of the type described by Smithies[6] in 1917 and also mentioned by Ewing. This type of peritonitis is usually secondary to lymphosarcoma or lymphoblastoma and has its origin in the adenoid tissue along the spine.

SUMMARY

Lymphosarcoma may involve any portion of the intestine but has a predilection for the ileum. In the colon its most common location is in the rectum. The condition is rare, about three hundred cases having been reported. The growth of the tumor is extremely rapid and the condition may terminate fatally in a few weeks or months. There is nothing characteristic about the symptomatology and the disease is rarely recognized before operation or necropsy. Roentgenologic examination may be of considerable help in locating the lesion in some cases and offering a clue

as to its identity. The prognosis is bad, and either eradication or some form of sidetracking operation is the usual surgical procedure.

A case of seven weeks' duration in a man, age twenty-three, is described. The early clinical picture was similar to that of acute gastritis. Nausea, weakness and loss of weight were the most important symptoms. Intestinal obstruction developed, and combined roentgenologic and fluoroscopic examination showed the seat of obstruction to be in the sigmoid. Cecostomy and delivery of the sigmoid growth through the left abdominal wall were performed but the patient died of peritonitis. Postmortem examination revealed a lymphosarcoma of the sigmoid with involvement of the abdominal lymph nodes.

My thanks are due to Dr. Dalldorf, of the New York Hospital, for his coöperation, particularly with reference to the study of the postmortem findings.

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BALL-VALVE COLOSTOMY OPENING IN CASE OF ADENOCARCINOMA OF THE RECTUM*

GEORGE A. WYETH, M.D.

NEW YORK

E H., male, fifty-four years old, an inventor. Two and one-half years ago had an adencarcinoma of rectum just below the junction with the sigmoid. He had lost greatly in weight, was anemic, somewhat cachectic and badly run down. He suffered chiefly with obstructive symptoms. Diagnosis was fixed with the sigmoidoscope and confirmed by Dr. Frank C. Yeomans who was associated in the case.

In June, 1925, incision in right abdomen and examination for possible liver involvement was made. Palpating down in pelvis a large, movable mass was located which seemed confined to the rectum. After ligating the sigmoid artery, the diseased segment was severed between clamps and removed. The lowermost pair of clamps on distal portion of rectum was left in situ but withdrawn one week later when we removed the remainder of the rectum and anus by the perineal route, thereby completing a modified Coffey operation. The proximal portion of the gut was brought out through a small opening in left rectus and sides of gut stitched to the skin leaving about 7 cm. protruding.

Now the interesting thing about this case is that a hole was made on the side of the gut with the result that the feces do not come through the lumen of the exposed gut but through the newly made opening in the side. The redundant gut has atrophied to a small knob and has formed what I like to call a ball-valve colostomy. This completely plugs the opening and when covered with a small piece of removable gauze and belt applied prevents leakage. As a result, patient ordinarily has a bowel evacuation in the morning after which he cleanses himself, applies a fresh piece of gauze and his belt and goes about his business (with no colostomy odor about him). This case was done throughout by means of the endotherm knife.

* Read before Section of Surgery, New York Academy of Medicine, January 6, 1928.

＊ EDITORIALS ＊

BIRTHDAY

TWO years is a short time when one looks backward, but we have a feeling which has grown with the passing months that with our first issue of the New Series of THE AMERICAN JOURNAL OF SURGERY in May, 1926, we were inaugurating something new. The rejuvenation of a going concern presents more difficulties than does starting at the beginning with no handicap of tradition. With this first issue we formulated a plan for a surgical publication that might be in fact, as well as in name, *The* AMERICAN JOURNAL OF SURGERY.

In the May, 1926, issue this statement was made: "In the development of our plans for the betterment of the JOURNAL we shall be guided by two standards— useful service and a high quality of journalism." The present issue is modestly submitted as a step in that direction.

Sir William Osler, at the birth of another journal (*The Annals of Medical History*) wrote: "With the active sup- port of all good men it will be a great success." The support of many of the good men of the profession has already been secured for the *new* AMERICAN JOURNAL OF SURGERY, and we humbly believe that the evidence is shown in its pages.

If only half of the promises for further cooperation now in hand are fulfilled, this will be a journal that is destined to take its place as the leader in its field. It is felt that as birthday follows birthday the trend toward further enlargement, progress and improvement will be apparent.

We will not sit back and with a self-satisfied air claim to have reached perfection. This goal, like the pot of gold at the end of the rainbow, is never reached. We do, however, look with pride at what has already been accomplished. The JOURNAL'S influence is being felt in many surgical centers. We note that it is frequently quoted in the literature. In the Year Books THE AMERICAN JOURNAL OF

Surgery has a large percentage of its contributions abstracted. Surgeons of national and world-wide reputation send in manuscripts for publication. We have cordial relations with recognized surgical clinics and their workers in various parts of the world.

We do not intend to outline what we have on hand for the future. Let it suffice that this material is of a high order of scientific merit; it is better that the readers of The American Journal of Surgery judge for themselves.

Our birthday dawned. We have looked admiringly at the two lighted candles on our birthday cake. We feel that we have kept our promises. We have high hopes for the future. The party is over. Come! To our desks and back to our tasks!

—The Publisher and the Editor.

BRITISH LETTER

Let us now praise famous men . . . leaders of the people by their counsel, and by their learning meet for the people, wise and eloquent in their instruction.—*Ecclesiasticus, xliv, 1.*

THIS letter will be devoted to the memory of John Hunter, the founder of modern scientific surgery in this country, for on February 14th, two hundred years ago, Hunter was born at Long Calderwood, some seven miles from Glasgow.

During the month of February the bicentenary celebrations in honour of John Hunter were held at the Royal College of Surgeons, for he was the founder of the museum there and is regarded as the patron saint of the society. Demonstrations were given by the Conservator of the Hunterian Museum, Sir Arthur Keith, and by the Librarian, Mr. Plarr. The Hunterian Oration was delivered by Sir Holburt Waring, and the Thomas Vicary Lecture by Dr. G. C. Peachey. The festival dinner was held at the College under the presidency of Sir Berkeley Moynihan. Other meetings in his honour were held at his old hospital, St. George's, and the Hunterian Society held a festival banquet on February 9th. It must be recalled that the Royal College of Surgeons was not established until 1800, absorbing the Corporation of Surgeons of London which was founded in 1745, and continued the functions of the old Court of Assistants with greatly enhanced powers. The former Court of Assistants was appointed by the company to undertake the examinations for surgeons to His Majesty's Army and Navy and for the diploma of the company. John Hunter was elected with Percival Pott one of first masters of anatomy of this ancient corporation and later became a member of the Court of Assistants.

It was the Corporation of Surgeons which took over Hunter's collection of preparations, manuscripts and books for which the sum of £15,000 had been paid by the Government. In 1806 a further sum of £15,000 was received by the College of Surgeons from Parliament to build a museum to house the collection. In 1800 the Corporation of Surgeons had become, by a charter dated March 22nd, the Royal College of Surgeons in London. This charter was eventually obtained from George III, after the defeat of a bill in Parliament asking that greater powers be given to the Corporation over the profession. The company was thus converted into a college with greatly extended powers over the practitioners of England and Wales with the purview that the art and science of surgery might be better cultivated and the commonwealth of the people of this kingdom benefited.

In 1843 the name of the College was once more changed to the title it now retains, the Royal College of Surgeons of England, with its present constitution of President, Vice Presidents, Council, Fellows and Members. Since 1814 the Hunterian Oration has been given in the College, at first annually but since 1856 biannually, to the memory of John Hunter. The condition of the trust which created this oration requires that

The oration is to be delivered in the theatre of this College (the Royal College of Surgeons) on the 14th. February and such oration is to be expressive of the merits in Comparative Anatomy, Physiology and Surgery, not only of John Hunter but also of such persons who have become deceased, whose labours have contributed to the improvement and extension of surgical knowledge.

Sir Holbert Waring, M.S., F.R.C.S., Surgeon to St. Bartholomew's Hospital, a and a pioneer in surgery, declared that it was essential for a surgeon who wished to practice his art with the greatest prospect of success and benefit to his patients, that he should have a close and detailed knowledge of the structure and functions of man in health; that he should be familiar with the changes which take place in man during the onset, course and development of any disease which he is called upon to treat, and furthermore that he should also have

JOHN HUNTER (1728–1793).

Vice President of the College, was the chosen orator on this special occasion and gave a most interesting though necessarily brief review of the progress of surgery from Hunter's time to the present day, recording more particularly the results of the work of those pioneers in the science and art of surgery, which has proved of the greatest value in the development of modern practice and technique.

Hunter after some ten years of surgical practice (1760–70), already acknowledged a great teacher, a profound anatomist, a comprehensive and detailed knowledge of the vital processes which take place in the tissues of the patient during the period of recovery from disease and after the performance of a surgical operation.

Hunter endeavored to carry out these essentials by making intensive investigations as to the natural structure and functions of the organs of man, comparing these with numerous and diverse anatomical and physiological studies on animals, and further noting the various alterations under conditions of disease. On these

findings he endeavoured to develop surgery on a real scientific basis. The greatest credit is due to him for the introduction of the experimental method as a means of ascertaining the truth in questions of pathology.

In his address Sir Holburt touched upon the advances in applied physiology, pathology and biochemistry. He discussed the development of anesthesia, local and general, the progress made in the evolution of the modern surgeon's armamentarium and the great changes made in the construction of surgical hospitals and operating theatres. He compares these vastly improved facilities with the somewhat crude methods of Hunter's time and with conditions in the early days of Lister, and does not omit to emphasise the important aids to diagnosis and treatment now at the disposal of the surgeon accruing from the wonderful development of the science of radiology and the use of radium. In his conclusion he says that in his opinion

The main lines of advance of surgery in the future will be along biochemical and biophysical lines both as regards diagnosis and treatment. If this assumption be correct it is essential that the medical student and the general practitioner of the future should pay increased attention to all biochemical and biophysical problems both in normal and diseased conditions.

Some hitherto unpublished letters written by Wm. Hamilton, son of the Thomas Hamilton who held the chair of anatomy in Glasgow from 1757 to 1781, have been entrusted for publication and presented to the Council of the College by Dr. Louisa Hamilton. These letters, recently published in *The Lancet*,[1] were written in the winter of 1777–78 when the War of Independence was being fought in America. They give most interesting glimpses into the life of the period. Young William Hamilton is loud in his praises of John Hunter as a teacher and lecturer. Sir Arthur Keith is convinced that it was the elder Thomas Hamilton who accompanied John Hunter when he set out on horseback from Glasgow to join his brother William in London in September, 1748, the journey occupying fifteen days. Thomas Hamilton worked with John in William Hunter's dissecting room, eventually returning to Glasgow where he succeeded his brother Robert in the Chair of Anatomy in 1757.

One other most informative letter is included from Dr. Wm. Irvine to Professor Thomas Hamilton. The letter is dated June 17, 1771; the writer says he had spent most of the time for the past fortnight with John Hunter "from whom I have received a great deal of what is new to me, and which, though it may not be so much to you, cannot be disagreeable." It shows the variety of Hunter's experimental work, describing in brief some observations of his on wounds, hydrocele, experiments on the blood and blood vessels, the grafting of teeth and testes and some comments on the practice of midwifery with allusions to the methods of treatment of Dr. William Hunter and of his disinclination to use any instrument whatever in delivery and among other details that he never attempted to force the extension of the placenta. It appears that Irvine and Thomas Hamilton had studied together under Dr. William Hunter, and both were cited as witnesses when William Hunter accussed Munro Secundus of plagiarism. These letters provide most convincing proofs of John Hunter's geniality, his kindly disposition and his skill as a teacher. They give numerous instances of his boundless energy, his great enthusiasm and zeal for all and every kind of research bearing upon not only surgery but anatomy, physiology and experimental pathology, and mark him the master of scientific surgery of the eighteenth century. It is, therefore, peculiarly fitting that these letters should come to light during the present celebrations.

Dr. G. C. Peachey gave the Thomas Vicary Lecture, choosing for his subject "The Homes of the Hunters" and recall-

[1] John Hunter: Bicentenary Celebration. *The Lancet*, 1928, ccxiv, 354–360.

ing many incidents in the extraordinarily active lives of the brothers, William and John, in the London of the eighteenth century. He spoke of the beginnings of William Hunter's prosperity, his association with Smellie and Douglas, the launching of the School of Anatomy and its success under his guidance and the industry of his brother John.

We get gleanings of the development of John Hunter as an anatomist and surgeon, of his career at St. George's Hospital, particulars of his experiments in his letters to his favorite pupil, Jenner. In fact we read of his tremendous energy and devotion to the cause of the science he loved, and how he was prepared to lavish almost all his money on the collection of specimens for his museum. At his country house at Earl's Court he devoted himself to the study of biological problems and was eager to buy any animal he could lay hands on alive or dead for this purpose. The large house in Leicester Square he converted in part into a museum, lecturing theatre and dissecting rooms, although in doing it he sadly crippled his resources and was obliged to borrow money on loan. We are told again that John Hunter was not altogether an easy person to get on with, and that neither he nor his brother could endure opposition. This may be so but I cannot conceive that he was not a likeable man, for he undoubtedly possessed the affection of most of his pupils and of all those who knew him intimately and worked with him. Paget in his life of John Hunter suggests that between the ages of thirty and forty years he conquered the roughness, ignorance and isolation of his earlier life. In his married life he was most fortunate and confessed himself to be one of the happiest men living. There is no doubt that the loss of his brother's friendship was a bitter grief to him, otherwise he would not have been so overcome with emotion when he told his pupils of the loss which anatomy had sustained by his brother's death.

John Hunter's association with St. George's Hospital was marred by the petty jealousies of his surgical colleagues, which were greatly intensified by the fact that he openly despised them for their lack of enthusiasm and initiative in their work. Further he did not hesitate to accuse them of general indifference and neglect in teaching the hospital pupils. His censure was to some extent deserved, for one of his colleagues avowed that he did not choose to lose any reputation he might have in surgery by giving lectures, and another confessed that he did not see where the art could be improved. Nevertheless, we know that neither Gunning, Walker nor Keate, his three surgical colleagues, could be described as incompetent; they were certainly not men to be pushed roughly aside or despised, for they had proved themselves surgeons of ability and keen rivals in practice, and consequently were not going to be overridden without a struggle, even though Hunter might be their superior in mental capacity and professional attainments.

Throughout his struggles with these vigorous opponents Hunter probably felt in his own mind that his personal record of attainment would eventually carry the support of the Board of Governors in his favour. His last requisition to the Board was that they would admit two pupils under him who had not certain credentials which others of his colleagues thought necessary. The meeting of the Board was fixed for October 16, 1793. Hunter that morning told a friend there would be a dispute and he felt sure it would be the end of him. He arrived late at the meeting, presented the petition of his two pupils and spoke on their behalf. One of his colleagues flatly contradicted something he said. Hunter immediately stopped speaking, suppressing his feelings of rage and mortification; he was seized with the pain of a sudden attack of angina and hurriedly withdrew from the meeting and staggered into an adjoining room where with a deep groan he fell lifeless into the arms of Dr. Robertson who chanced to be there.

Such was the tragic end of John Hunter. Yet even this sudden fatal seizure brought forth no kindly thought or sympathetic action from his colleagues on the staff or from any other members of the Board. At the next meeting of the Board there was no mention of the tragedy not even a vote of condolence. It is sad to think that the bitterness of hostility remained and his merits were not appreciated by his generation. Despite his rugged exterior and his occasional harshness he loved his friends. By his great industry he acquired knowledge which he hoped would command the respect if not the admiration of his professional brethern; instead he was the subject of their envy, hatred and malice. At the time of his death his isolation from his surgical confreres at the hospital where he had given so great and so devoted service was in fact complete. This subtle antagonism to a man of his disposition must have been a grievous disappointment and must have aroused in him the bitterest feelings of resentment which would be most difficult to suppress.

Despite his peculiarities of temper and his occasional rudeness he had a heart of gold; he loved his friends and was ever ready to sacrifice his time and willing to place whatever resources he had at their disposal, hoping at least that his affection would be returned. But in this he was sorely disappointed, and must have felt the truth and bitterness of his brother William's complaint to his sister, Mrs. Baillie: "That I have lived to have my affections much disturbed by ingratitude!" Of all his pupils, Edward Jenner undoubtedly was the most dear to him and kept his confidence and highest regard until his death. We are told by Baron that Jenner called John Hunter "the dear man" and when he described the honesty and warmth of his heart and his never-ceasing energy in the pursuit of knowledge, it was impossible not to be animated by the recital.

Two of his old pupils, Adams and Abernethy, spoke of him as an excellent teacher and a most agreeable companion. Abernethy said:

Mr. Hunter was a man of very considerable humour. His views of subjects in general were quick and peculiar, and when so disposed he could place them in a very ludicrous point of view. His greeting of the elder Physick was quite characteristic when he brought his son Philip Syng Physick to be his pupil and asked what books he should read, Hunter replied, "Sir, follow me, I shall show you the books your son has to study." He then took him into the dissecting room, and showed him the bodies. "These are the books your son will learn under my direction, the others are fit for very little."

Faults of temper should not be counted harshly against a man struggling against ill health for many years. In all other things he appears to have had a steady hold of himself, for we are told that he abstained from wine at a time when wine was drunk like water, forced himself to give lectures, took up his pen and undertook the to him particularly distasteful task of writing books. Not only did he make men work for him but he gave his pupils that insight into the knowledge of anatomy and surgery which produced later such famous men as Henry Clive, John Abernethy, Astley Cooper and William Blizard. Aided by a gracious and clever wife, he entertained generously at his town house numerous friends and celebrities of the time. The London of the eighteenth century was the London of Gay and Hogarth, of Fielding and Smollett, of Johnson and Goldsmith, of Garrick and Reynolds. Mrs. Hunter was the friend of Mrs. Montague and Madame D'Arblay and of Haydn, the musician, for whom she wrote the words for the Oratorio "Creation" and the song "My Mother Bids Me Bind My Hair." She published after his death a volume of poems and had inscribed an epitaph to Hunter on a memorial tablet in St. Martin's in the Field which reads:

Here rests in awful silence, cold and still,
One whom no common sparks of genius fired;
Whose reach of thought Nature alone could fill,
Whose deep research the love of Truth inspired.

Hunter! if years of toil and watchful care,
If the vast labours of a powerful mind
To soothe the ills humanity must share,
Deserve the grateful plaudits of mankind—

Then be each human weakness buried here.
Envy would raise to dim a name so bright;
Those specks which in the orb of day appear
Take nothing from his warm and welcome light.

Hunter loved his home life; he was a devoted husband and a fond parent. He often said that if he had been allowed to bespeak a pair of children they should have been those with which Providence had favoured him. Despite such a lovable nature, he was denied the friendship of the surgical colleagues he had to work with and compete against. Is it unnatural that he was embittered and that at times of extreme irritation he should denounce them in mild terms?

Peachey ends a most engaging address with the following words:

In the brilliant sunshine of modern surgical progress begun by Simpson with the introduction of chloroform anesthesia and culminating in the magnificent triumph of Lister, our eyes are apt to be blinded by the debt we owe to the perseverance and genius of John Hunter.

This last general statement is a fascinating ending to a lecture full of historical interest, but in regard to the question of the introduction of anesthesia, we in England acknowledge that the honour and glory of first discovering how to produce anesthesia by using ether is linked up primarily with the pioneer efforts of Crawford W. Long and William T. G. Morton, and realise without entering into the claims, contradictions and counter claims that Long was the first man to operate successfully under ether anesthesia, and that Morton was the first to demonstrate its wonderful anesthetic properties to a gathering of medical men on a living patient at the Massachusetts General Hospital. On this great occasion John Collins Warren removed a tumour in the neck painlessly and successfully from "Gilbert Abbott, age twenty, Single, painter" on October 16, 1846. In England Robert Liston, famous for his boldness, rapidity and skill in operating, was one of the first surgeons to undertake an operation on a patient which he did under ether in London at the University College Hospital. Sir James Young Simpson, however, fought the battle for anesthesia in this country and successfully established the practice of anesthesia in the face of great opposition, but it is clear to us today that Simpson magnified the superiority of chloroform over ether. He looked upon ether as a stage in the development of a more perfected anesthesia which he had been able to introduce by using chloroform. Laing Gordon says Simpson regarded chloroform as the only anesthetic; his utterances betrayed this feeling, and offence was naturally taken by the introducers and advocates of ether. He succeeded, however, in convincing the leading surgeons of Europe of its many advantages so that in a short time and with a few exceptions it was for a considerable period in general use as the anesthetic of choice.

This digression leads me to refer to a remarkable passage in the Greville Memoirs, republished this year, in which Charles Cavendish Fulke Greville (Clerk to the Privy Council, a kinsman of the Duke of Portland and the Earl of Warwick of that day) describes as a novelty the use of an anesthetic. The date on which Greville witnessed the operation was December 24, 1847, the year in which Simpson first began to employ chloroform as a general anesthetic.

I went yesterday to St. George's Hospital to see the chloroform tried. A boy two years and a half was cut for a stone. He was put to sleep for a minute; the stone was so large and the bladder so contracted, the operator could not get hold of it, and the operation lasted above twenty minutes, with repeated probings by different instruments. The chloroform was applied from time to time, and the child never exhibited the slightest sign of consciousness and it was exactly the same as operating on a dead body. A curious example was shown

of what is called the etiquette of the profession. The operator (whose name I forget) could not extract the stone, so at last he handed the instrument to Keate, who is the finest operator possible, and he got hold of the stone. When he announced he had done so, the first man begged to have the forceps back that he might draw it out and it was transferred to him; but in taking it he let go the stone and the whole thing had to be done over again. It was accomplished, but not of course without increasing the local inflammation and endangering the life of the child. I asked Keate why, he had got hold of the stone he did not draw it out. He said the other man's dignity would have been hurt if he had not been allowed to complete what he had begun. I have no words to express my admiration for this invention which is the greatest blessing bestowed on mankind, and the inventor of it is the greatest of benefactors whose memory ought to be venerated by countless millions for ages yet to come. All the great discoveries of science sink into insignificance when compared with this. It is a great privilege to have lived in times which saw the production of steam, of electricity, and now of ether, that is, of the development and application of them to human purposes, to the multiplication of human enjoyment and the mitigation of pain. But wonderful as are the powers and the feats of the steam and the electric telegraph, the chloroform far transcends them all in its beneficient and consolatory operations.

I have taken the privilege of quoting this remarkable passage in full for I would call attention to Greville's curious observance of the incident of what he calls the etiquette of the profession, to his admiration for the skill of Keate, who in this instance happened to be Robert Keate, the nephew and successor at St. George's of John Hunter's bitter antagonist, Thomas Keate. But more particularly would I call attention to the tremendous impression the successful administration of an anesthetic had upon the mind of an intelligent observer and man of the world of this early Victorian period, and his fervent declaration of its wonderful influence for the good of suffering humanity.

JOHN H. WATSON.

Burnley, England.
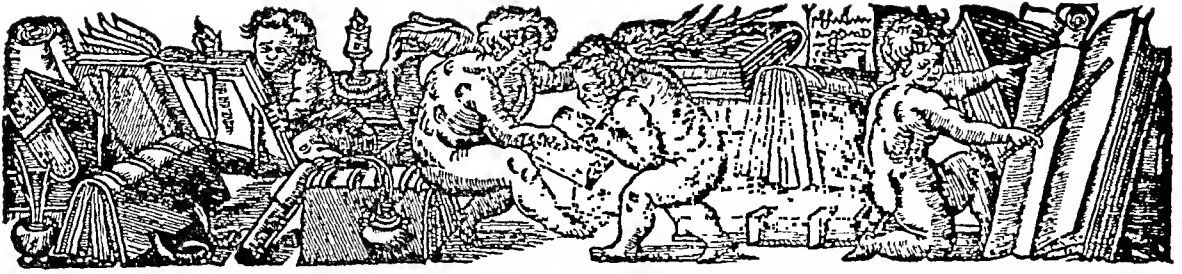
[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

THOMAS ADDIS EMMET, 1828

Charles A. Gordon, m.d., f.a.c.s.

BROOKLYN

Thomas Addis Emmet needs no eulogy. Words of appreciation are futile, no more necessary than the unwritten epitaph of his immortal ancestor, Robert Emmet, whose ringing words are known to every schoolboy:

Let no man dare when I am dead to charge me with dishonor. Let no man attaint my memory . . . Let no man write my epitaph, for, as no man who knows my motives dare now vindicate them, let not prejudice or ignorance asperse them. Let them and me rest in obscurity and peace, and my tomb remain uninscribed, and my memory in oblivion, until other times and other men can do justice to my character.

Just as Robert Emmet, by a single speech, became the most memorable of the many martyrs of Ireland, so Thomas Addis Emmet, by his work in vesicovaginal fistula, has won a place among the immortals of medicine.

Founded largely upon the work of McDowell and Sims, operative gynecology had its beginnings in this country. The famous operation upon Mrs. Crawford was done in 1809, yet in 1790 William Baynham of Virginia had successfully operated for extrauterine gestation, and in 1816 John King of Edisto Island, South Carolina, had performed a remarkably successful operation for abdominal pregnancy.

Before 1852 vesicovaginal fistula was a very common and all but hopeless lesion. Since Ambrose Paré, the great surgeons of the world had attempted its cure. Many operative procedures had been recorded and a few successes had been reported by Mettauer of Virginia, Hayward of Boston, Pancoast of Philadelphia and Maisoneuve in France.

Then J. Marion Sims, with a wave of his hand, transformed the Cinderella of surgery into the lovely lady of gynecology. Sims and Emmet! The greatest names in gynecology. Master and pupil. Sims, the teacher of Emmet and Emmet, the teacher of us all. As Kelly says, "He caught Sims' idea at once, acquired his methods and improved upon them, and did more than any other surgeon to teach the members of the profession in this country how to do these operations."

It is peculiarly fitting that at this time we commemorate his service to gynecology, if not by solemn observance, then by calling to mind the accomplishments of his long and useful life.

Just a hundred years ago, on May 29, 1828, Thomas Addis Emmet was born.

His was a great heritage. In his veins ran the blood of martyrs, of men of steadfast purpose and unyielding principle who suffered and died and abandoned home and

country for the right of free speech and liberty. Seven generations of Emmets had been physicians, many of whom had been more than ordinarily distinguished. Another Thomas Addis Emmet, his grandfather, after whom he was named, suffered imprisonment and exile, after his brother Robert had met his death upon the scaffold. When he came to New York in 1804 on his way West, Governor Clinton persuaded him to remain. One of his sons, John Patten Emmet, after practicing medicine in New York, was appointed by Thomas Jefferson to the chair of Natural History in the University of Virginia. Here at Charlottesville Thomas Addis Emmet was born.

His childhood at the University was gloriously crowded with memories of great men and events. A journey to New York, made chiefly by stage coach, required nearly a week. He walked over a bridge at Canal Street, crossed a dusty country road called Broadway into a cornfield and looked upon the Astor House as one of the greatest buildings in the world.

Studying medicine at Jefferson, he was graduated in 1850. Although his knowledge of anatomy was excellent, he had dissected but a single muscle and had never attended an obstetrical case. Medical education apparently left much to be desired, as it does now.

This was just after the frightful Irish famine when several hundred thousand immigrants landed in New York and were dying everywhere of ship fever or typhus. Temporary buildings for three or four thousand beds were erected on Wards Island. Here Emmet served as resident physician for three years, contracted typhus twice, nearly losing his life both times.

Appointed a visiting physician to the hospital at a salary of four dollars a day, he soon married and made every effort to build up a private practice from which his first year's income was fifty dollars. His honorarium for tenement house calls was twenty-five cents.

The association with Sims, which changed the whole course of his life, had a most romantic and unusual beginning. It will bear repetition here in Emmet's own words:

In the early spring of 1855, I was engaged late one night with my case book in tabulating all the features of each typhus fever case I had treated at Wards Island, so as to obtain, as it were, the natural history of the disease. It had been snowing all day and the quiet was

Fig. 1. Thomas Addis Emmet, m.d. (1828–1919).

conducive to continued work, when I was startled by a loud rap on my window. On opening the door I admitted Dr. Marion Sims, whom I had met before, but I did not recognize him until he introduced himself. He stated that his car had gotten off the track almost opposite my house and seeing my light burning he had come in to warm himself, as he had become chilled from standing so long outside.

After he had revived, seeing my table covered with papers, he asked what work I was at. On explaining the system and what I expected to accomplish, he suddenly said: "Well,

Doctor, you are just the man I am looking for, and if you will come up to the hospital tomorrow morning at nine o'clock I will show you something you have never seen before . . . and I can have you to assist me."

The next morning for the first time Emmet watched Sims close a vesicovaginal fistula. Here at the Womans' Hospital after five and a half years association with Sims, Emmet became a great master of the plastic surgery of the bladder, the perineum, the vagina and the cervix.

For years he gave three clinics a week, with blackboard and chalk, detailing every step of the operation. These clinical lectures were the first of the kind and were attended by surgeons from all over the world. This, with his contributions to medical literature and his book, "The Principles and Practices of Gynaecology," which was published in 1879, reflected great credit on the Woman's Hospital.

His monograph on "Vesico-Vaginal Fistulae," published in 1868, was dedicated

FIG. 2. Residence of Professor Emmet near the University of Virginia. From a pen-drawing made from memory in 1898 by Dr. T. A. Emmet. Figures 1 and 2 are reproduced with permission of the executor from "Incidents of My Life" by Thomas Addis Emmet," N. Y., G. P. Putnam's Sons, 1911.

He was a tireless, painstaking operator, with wonderful hands, patience, persistence and marvelous native ability. He had a great fondness for the mechanical arts and once owned a collection of tools selected from almost every trade. With these he could fashion out of wood or iron almost anything he desired. Even at the beginning of his work he wrote careful histories of all his cases with drawings and descriptions of the operation.

"To J. Marion Sims, My Instructor." Although he operated upon 600 cases, only 270 were recorded here. He pointed out that only three of these were due to use of the forceps, the others to delayed delivery and impaction slough. His clear statement as to its etiology did much for backwoods obstetrics.

Large fistulae were closed, sometimes by repeated operation, under ether or opium anesthesia, some in the Sims position,

some in the knee-chest. He was an adept in the use of scissors. "Scarcely any case," he said, "can be regarded as incurable in consequence of loss of tissue alone. So certain was he of successful end result that he advocated temporary fistulae for bladder drainage in cystitis. He made button holes in the urethra for diagnosis, and often closed vaginal fistulae temporarily with silver wire without denudation of their edges.

He made careful anatomical studies of the fascial supports of the perineum, described the etiology of perineal laceration and devised an operation which has served as a basis for discussion ever since. Thomas had said that a woman might better break her leg than her perineum.

His work on the cervix is memorable. He first called attention to its frequency of laceration, described its pathology and symptoms, and first repaired the cervix in 1862, using a uterine tourniquet made out of a portion of a watch spring, to control bleeding during the operation. "So long," he said, "as there can be detected, by pressure from the finger, any tenderness in the neighboring connective tissue, it is not safe to operate."

When his paper was presented, Dr. H. T. Hanks said, "Many of us have not realized that the lesion described by Dr. Emmet is a common one." Marion Sims said,

"I only wonder that this operation had not been worked out sooner. The operation as devised and practiced by Dr. Emmet is as simple, as safe and as certain in its results as is the operation for a simple case of vesicovaginal fistula. We must accept it as Dr. Emmet has given it to us. We cannot change it. We cannot improve it, for it is perfect—perfect in its method, and perfect in its results."

It is interesting to note that Dudley, once his resident surgeon, coined the word trachelorrhaphy and submitted it to Emmet who consulted Peasles, a scholar with a great reputation. With his approval the word first appeared in a paper by Dudley.

With the publication of fifty or more papers on medical subjects, Emmet wrote and lectured often on English rule in Ireland, at first as a medical student. All his life he was closely identified with Irish politics, his faith and enthusiasm increasing with the years, his love of liberty burning with undiminished flame.

In his love of letters he was not surpassed by his classmate, S. Weir Mitchell. For years the second floor of the house next to his was wholly filled with his library and collection of Americana. He had collected documents with complete autographs and portraits of every individual connected with the Albany Congress of 1754, the Stamp Congress of 1774, the various Continental Congresses, and a set of the Signers of the Declaration of Independence with an original copy of the Declaration in Jefferson's handwriting, a full history of its passage and signing and original autographs and portraits of the Signers. He also possessed material on the Articles of Federation, the Annapolis Convention (with the original minutes) and the call for the Constitutional Convention with its first amendments as passed and certified by the Vice President and the Secretary of the Senate. There were thirty thousand portraits in all, a large collection of Colonial paper money, Confederate paper and bonds and one hundred and fifty bound volumes of Colonial newspapers. Tireless research occupied many years of his life.

Thomas Addis Emmet was present as a medical student at the first meeting of the American Medical Association in the Academy of Natural Sciences, Philadelphia. He was twice Vice President of the Medical Society of the County of New York, a founder of the American Gynecological Society in 1876 and its President in 1882. His was a clean life, rich in honors. It ended in death in 1919.

"A physician is worth many men."

BOOK REVIEWS

SURGERY. ITS PRINCIPLES AND PRACTICE FOR STUDENTS AND PRACTITIONERS. By Astley Paston Cooper Ashhurst, A.B., M.D., F.A.C.S.; Professor of Clinical Surgery, Univ. of Pennsylvania; Surgeon, Episcopal and Philadelphia Orthopedic Hosps. and Infirmary for Nervous Diseases; Colonel, Medical Reserve Corps, U. S. Army. Ed. 3. 8 vo. Cloth. Pp. 1179, 15 colored plates and 1046 illus. Phila., Lea & Febiger, 1927.

Ashhurst has improved his work with each edition and this one may be sincerely recommended for study as a textbook of general surgery. Many sections have been entirely rewritten or introduced as new matter, and the book shows wide reading and generous reference to the work of others. As in the earlier editions, bibliographic references are omitted, but the names of surgeons cited are followed by the year of the publication cited, which makes library work easier. There is, too, an index of authors in addition to the subject index. The more important operations and surgical manipulations are described in detail. In this edition the illustrations, many of them new, are nearly all original.

Here and there Ashhurst's methods are boldly at variance with those more generally accepted and, we think, more modern. Some years ago he wrote a prize essay on fractures of the elbow, and the section of his book devoted to that subject we commend for careful reading. But concerning the treatment of fractures of the upper end and the shaft of the humerus, the student would do well to read other works.

* * *

MINOR SURGERY. By Arthur E. Hertzler, M.D., F.A.C.S.; Chief Surgeon, Halstead Hosp., and Victor E. Chesky, A.B., M.D., F.A.C.S.; Chief Resident Surgeon, Halstead Hosp. 8 vo. Cloth. Pp. 568, 438 illus. St. Louis, C. V. Mosby Co., 1927.

This attractive and profusely illustrated book is intended as a help to the worker in out-patient surgical departments, and the novitiate in that field will certainly find much instruction here. The book by no means covers, however, the whole field of minor surgery, and yet in some places it goes well outside of it. We do not think, for example, that the technique of operations for umbilical and femoral hernia belongs to minor surgery or to the dispensary, nor does operation for inguinal hernia except, perhaps, in infancy.

* * *

ROSE AND CARLESS' MANUAL OF SURGERY. For students and Practitioners. By Albert Carless, C.B.E., M.B., M.S. (Lond.), F.R.C.S., F.A.C.S. (Hon.); Emeritus Professor of Surgery, King's College, London; Consulting Surgeon, King's College Hosp., and Cecil P. G. Wakeley, F.R.C.S. (Eng.), F.R.S. (Edin.); Erasmus Wilson Lecturer, Royal College of Surgeons of England; Assistant Surgeon, King's College Hosp.; Lecturer in Surgery, King's College Hosp. Medical School; Assistant Surgeon, Belgrave Hosp. for Children, and West End Hosp. for Nervous Diseases. Ed. 12. 8 vo. Cloth. Pp. 1544; 639 illus. N. Y., William Wood & Co., 1927.

"Rose and Carless," now thirty years old, is the classic of modern British textbooks of general surgery with which, among American single-volume works, we would compare only the extensive treatise of DaCosta. With this and with other textbooks of general surgery in this country, "Rose and Carless" shares popularity with American students.

It is but three years since the preceding British and American editions appeared, but there has been no inconsiderable revision and several new illustrations added. In this work Prof. Carless has had Mr. Cecil P. G. Wakeley as an associate, and others have helped in revising special sections, as in pathology and anesthesia.

* * *

EMERGENCIES OF A GENERAL PRACTICE. By the late Nathan Clark Morse, A.B., M.D., F.A.C.S. Ed. 2, revised and rewritten by Amos Watson Colcord, M.D.; Surgeon, Carnegie Steel Co.; Surgeon, Pennsylvania Railroad System. 8 vo. Cloth. Pp. 541; 311 illus. St. Louis., C. V. Mosby Co., 1927.

Colcord's experience in industrial surgery fits him well for the revision of this interesting work. It is replete with practical instruction in the management of the accidents and emergencies of surgical, obstetrical and medical practice, and we commend it not only to the practitioner in smaller communities but to practitioners generally.

We would criticize only the description of the Crile method of blood transfusion by arterio-

venous anastomosis. This method has long since been superseded by simpler ones and certainly has no place in modern emergency surgery. The Lewisohn and Lindeman methods are described, but not the useful Unger method (which, however, requires a special apparatus). The book is attractively printed and very well illustrated.

* * *

PRACTICE OF UROLOGY AND SYPHILOLOGY. A Surgical Treatise on Genito-Urinary Diseases and Syphilis. By Charles H. Chetwood, M.D., LL.D., F.A.C.S.; Attending Urologist and Director of Service, French Hosp.; Consulting Surgeon, Bellevue Hosp.; Special Consulting Surgeon to Knickerbocker, St. Johns, Nassau, St. Agnes and White Plains Hosps. Ed. 4. 8 vo. Cloth. Pp. 879; 314 illus. N. Y., William Wood & Co., 1927.

Chetwood appears to have made a sincere effort to incorporate in this edition of his well-known work the advances in urology brought forth by the past few years. The revision has been too general to call attention to all the changes but, among others, is to be noted greater emphasis on the various pathological processes in gonorrhea, and on the specific, rather than the routine, treatment of cases according to the variations in these processes. Much has been added to the description of transurethral and transvesical endoscopic operations. The employment of the newer antiseptics is described. The techniques of caudal and spinal anesthesia have been incorporated. In the sections dealing with kidney and prostatic surgery greater emphasis has been laid on preoperative and postoperative care; the distinction between nephritis and nephrosis has been recognized and described, and the latest classification of surgical lesions of the kidney has been included. Focal infections in the urinary tract are discussed in the sections on diseases of the prostate and seminal vesicles. The employment of diathermy and new methods for applying radium in urology are adequately considered. Over one hundred new illustrations appear.

* * *

KURZE GESCHICHTE DER CHIRURGIE. Von W. von Brunn, Professor fur Geschichte der Medizin an der Universität Rostock. Mit 317 Abbild. Berlin, Julius Springer, 1928.

Although entitled a "short history" of surgery, this work of Professor Brunn's is much more comprehensive than most of the more extensive works which attempt to cover the field. Beginning with a resumé of all that is known of the surgical procedures employed by prehistoric or primitive peoples, Brunn passes to a consideration of the history of the art as preserved in the stone or other drawings and writings of the Egyptians, Chinese, East Indians, Mexicans and Peruvians. His account of early Greek and Roman surgery is adequate in all respects, and though he does not devote much space to the surgery of the Arabs, he manages to give in a few words an adequate account of Arabian surgery as practiced by its greatest exponent, Albucasis.

On the history of the art of surgery during the Middle Ages this book is particularly good. Brunn makes good use of the many manuscripts which have been discovered and studied by Sudhoff and his school. He has reproduced many illustrations showing that surgeons during the so-called "Dark Ages" were accustomed to perform many daring operations, and that although their knowledge of anatomy was of necessity limited they seem nevertheless to have operated on the most dangerous areas without fear.

The work of the surgeons of the Renaissance, Paré, Fabricius Hildanus and their contemporaries, is dealt with at length. Special sections describe how surgical science progressed steadily during the seventeenth century. The great discoveries of the nineteenth century—anesthesia, antisepsis, the roentgen ray—bring the history of surgery to its present apogee. Americans will read with interest the author's references to the achievements of their countrymen. Not only do Physick, Valentine, Mott, Gross and others of the historical past receive their mead but some of the living also figure in these pages.

Professor Brunn's book is remarkable for its breadth of view and philosophic tone, hardly to be looked for in a condensed narrative. A most notable feature is the profusion of illustrations and their appropriateness to the text. This is particularly striking in those which are used to illustrate the surgery of the Middle Ages and the period of the Renaissance.

An excellent bibliography is appended to the work. It is greatly to be hoped that an English translation will be made of this book, for it

would be of great value to the advanced student of the history of surgery as well as to the neophyte.

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COMPLETE TABLE OF CONTENTS PAGES I & III

This Month's Contributors Page 645

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The American Journal of Surgery

CONTENTS—DECEMBER, 1928

ORIGINAL ARTICLES

The American Journal of Surgery

CONTENTS—DECEMBER, 1928

Continued from page i

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CONTROLLABLE
SPINAL ANESTHESIA*

GEORGE P. PITKIN, M.D., F.A.C.S.

TEANECK, N. J.

TO review the history of spinal anesthesia would be a waste of time, as everyone knows that Corning performed the first lumbar puncture on a dog in 1884; that Matas in 1899 was the first in America to operate successfully with it and that Babcock was the first to take it up extensively as a routine anesthetic in 1904. It may be interesting, if not instructive, to know that Babcock and Boyd have each performed over twenty thousand operations with spinal anesthesia.

Yearly there are innumerable papers presented on the subject reporting so many cases each, but when these are reviewed and analyzed what is the result? It is merely to rehearse what has been accomplished by others. Therefore, when we condense these, a careful investigation will reveal the fact that much of our knowledge of spinal anesthesia may be attributed to Bier, Braune, Barker and Babcock, as they appear to be the few who really thought for themselves and endeavored to find ways of overcoming some of its disadvantages.

When the author first used spinal anesthesia in 1912, its use was confined to very elderly people, those considered as "bad risks," and to whom we were afraid to give ether. In those days we knew little or nothing about blood pressure changes and our only concern was whether we had anesthesia; we used to marvel at the fact that we had such "nice dry wounds. "It would seem that the impression has been generally prevalent among surgeons, until the last few years, that this form of anesthesia was suitable only for the bad risk cases and the aged; whereas of late the profession realizes that it is the ideal anesthetic for the young, robust individual, and is contraindicated in the moribund.

As we knew spinal anesthesia in the past it had many features that were undesirable and because of these it has been generally considered unsafe for routine use. It was not accepted by the profession as a safe and reliable anesthetic, because the duration of anesthesia was uncertain, one never knew whether it was to last ten minutes or an hour. The intensity was also variable, failures were frequent, and very often inhalation anesthesia had to be resorted to for the operation, or at least to complete it.

Nausea and vomiting were troublesome and embarrassing complications, oftentimes soiling the drapes and delaying the operation, due to expulsion of the viscera.

Not infrequently the patients complained of severe headaches and almost invariably they became covered with a cold, clammy perspiration accompanied by extreme pallor. There was relaxation

* Submitted for publication, November 5, 1928.

of the sphincters with incontinence and involuntary defecation.

They complained of extreme weakness and expressed fear of impending danger. There was air hunger in many instances. Not infrequently they became pulseless and, as Hillsman of the Department of Surgery, Yale University, expressed it, "The blood pressure was nothing over zero." As late as 1927 the assertion was made that: "The pulse at the wrist does not mean much clinically, because of the relaxed blood vessels in other territories, the blood vessels that have not been interfered with by the anesthesia also have their walls relaxed, but through another cause, through impoverished circulation. When the waves created by the heart reach these blood vessels they cannot be felt by the hand. They can neither be detected by the ear, when they are subjected to the pressure of the rubber sleeve of any blood pressure apparatus."

This quotation may be true of certain methods of spinal anesthesia, but not of all. The statement is one that would not instil confidence in the method with many surgeons. In other words these patients suffered profound shock.

Asphyxia has been a troublesome complication to deal with in the past, as well as the height of anesthesia on the body surface. Not infrequently we had anesthesia to the neck and even of the entire body. Possibly from this state originated, the term spinal anesthesia instead of spinal analgesia, which is correct.

After the primary effects of spinal anesthesia had disappeared, we frequently were confronted with various secondary complications directly attributable to the method. The most frequent of these were headaches, either the persisting, intense, throbbing, unbearable headache, or the dull headache, that occurred only when the patient sat up. Occasionally there would be paralysis of the sphincters, with the resultant dribbling of urine, or involuntary stool, lasting for days or weeks, or paralysis of the hypogastric plexus, which would necessitate catherization for an invariable time. Palsies were frequently reported, as well as vertigo. Localized areas of anesthesia or paresthesia would occasionally occur, lasting for several days after the operation. Stiffness of the muscles of the back of the neck were frequently observed, to say nothing of the innumerable cases of temporary blindness that have been reported.

With an endeavor to overcome some, or all, of these objectionable features we conducted a series of experiments using 92 humans, 38 cadavers, 264 dogs and 2278 rats. These experiments were not all in reference to spinal anesthesia, as comparative findings with various forms of inhalation anesthesia were also studied. As the inhalation results are not of interest at the moment, the results of these experiments will not be discussed.

To us an ideal spinal anesthetic appeared to be one that would be certain in effect, constant in duration, in direct ratio to the amount of anesthetic drug injected; one that would not in any way affect the heart action, arterial pressure or respiratory function; one that would lessen nausea and vomiting, abolish pallor, cold sweats; one that would eliminate anxiety of the patients, systemic disturbances and after-effects. The author says "we," because many of the experiments could not have been accomplished without a competent biological chemist, and Dr. Charles W. Hooper has devoted his time unhesitatingly for two years in perfecting spinocain. Some of the experiments and the reasons for our deductions may be of interest, as well as to know how spinocain originated; also the heavy concentrated solution of strychnine sulphate 2 mg., propantriol 65 mg., amyloprolamine solution 130 mg., novocaine 200 mg., distilled water q.s. 0.5 gm.

To gain control of the anesthetic agent within the dura, we used glass tubes shaped to conform to the human spine. In the larger ones we employed an isotonic solution, in the smaller tubes, which had a

capacity of 40 minums, human spinal fluid. In these tubes we tried various viscid substances in an endeavor to secure a solution that would mix but not diffuse with spinal fluid, that would remain en masse until the anesthetic drug had become fixed or absorbed, and that would not inhibit anesthesia, but regulate its durability and intensify its action, always bearing in mind the oscilatory action of spinal fluid due to (1) vascular pulsation and (2) external physical disturbance such as respiration, coughing, motion of the body, straining, vomiting, etc. To compensate for the first a clock-like arrangement was devised that would pulsate against the rubber cap of the tube, and the second was overcome by a bulb arrangement that would increase and decrease the intraspinal pressure in the tubes from 1 to 8 mm. Hg.

In 1927 starch paste was reported as an ingredient that would prevent dissemination for forty minutes. This was found to ferment, precipitate, and become unstable within six to eight weeks. Later we found that gliadine (the mucilaginous content of wheat starch) was the substance that really produced the viscid properties desired and from this we finally obtained amyloprolamine, which was stable and prevented dissemination for over two hours, or until the anesthetic action of the drug had disappeared. This was necessary because we had learned that by dissemination any anesthetic solution became weakened, which accounted for the uncertainty of duration and variation in intensity of spinal anesthesia as we knew it in the past.

To satisfy ourselves that a definite and fixed volume could be maintained throughout the duration of the anesthesia, to prove that dissemination did not occur, we colored the solution and did secondary taps on humans from twenty minutes to one hour after injection, obtaining no colored solution from the sixth or seventh dorsal interspace. A further check-up was made by adding stains to the solution, injecting it into the dural sac of dogs and noting the stained regions of the cord and dura.

By adding alcohol to the preparation, we produced a solution of lighter specific gravity than the spinal fluid, which caused spinocain to float in the spinal fluid as does the air bubble on a spirit level. By leaving out the alcohol and adding propantriol we obtained a solution with a specific gravity of 1.109, which is much heavier than spinal fluid (normal 1.007). This solution would gravitate to the dependent parts of the dura. The viscosity was not altered.

In an earlier report the author advised that if anesthesia did not extend high enough on the body, to elevate the head of the operating table and allow the spinocain to flow upward. This we found inadvisable and rather unsafe, particularly in the hands of the inexperienced, as the anesthetic ascends quicker in the spinal canal than anesthesia appears on the body surface, the anesthesia being delayed from three to six minutes after the spinal nerves are bathed with the anesthetic solution. Therefore it became necessary to determine the capacity of the dural sac at various heights to enable us to anesthetize various groups of spinal nerves as desired (Fig. 1). This was accomplished by coloring the spinocain with methylene blue and making secondary taps along the spine until we obtained clear fluid. For further check eosin was added to the light and heavy solutions and injected into cadavers, the body, being maintained in a position similar to that of a patient on the operating table, the solution expanded in a similar manner, and the results observed by doing a laminectomy. Adding sodium iodide to a solution of the same specific gravity and viscosity as spinocain, we injected this into the spinal canal of cadavers and roentgenographed them (Fig. 2). The result verified our other findings. With the dural sac capacity determined, it was easy to anesthetize various pairs of spinal nerves at will, by expanding the solution, as described under Technique.

The toxicity of novocaine injected intradurally is practically the same as when introduced intravenously. When 300 mg.
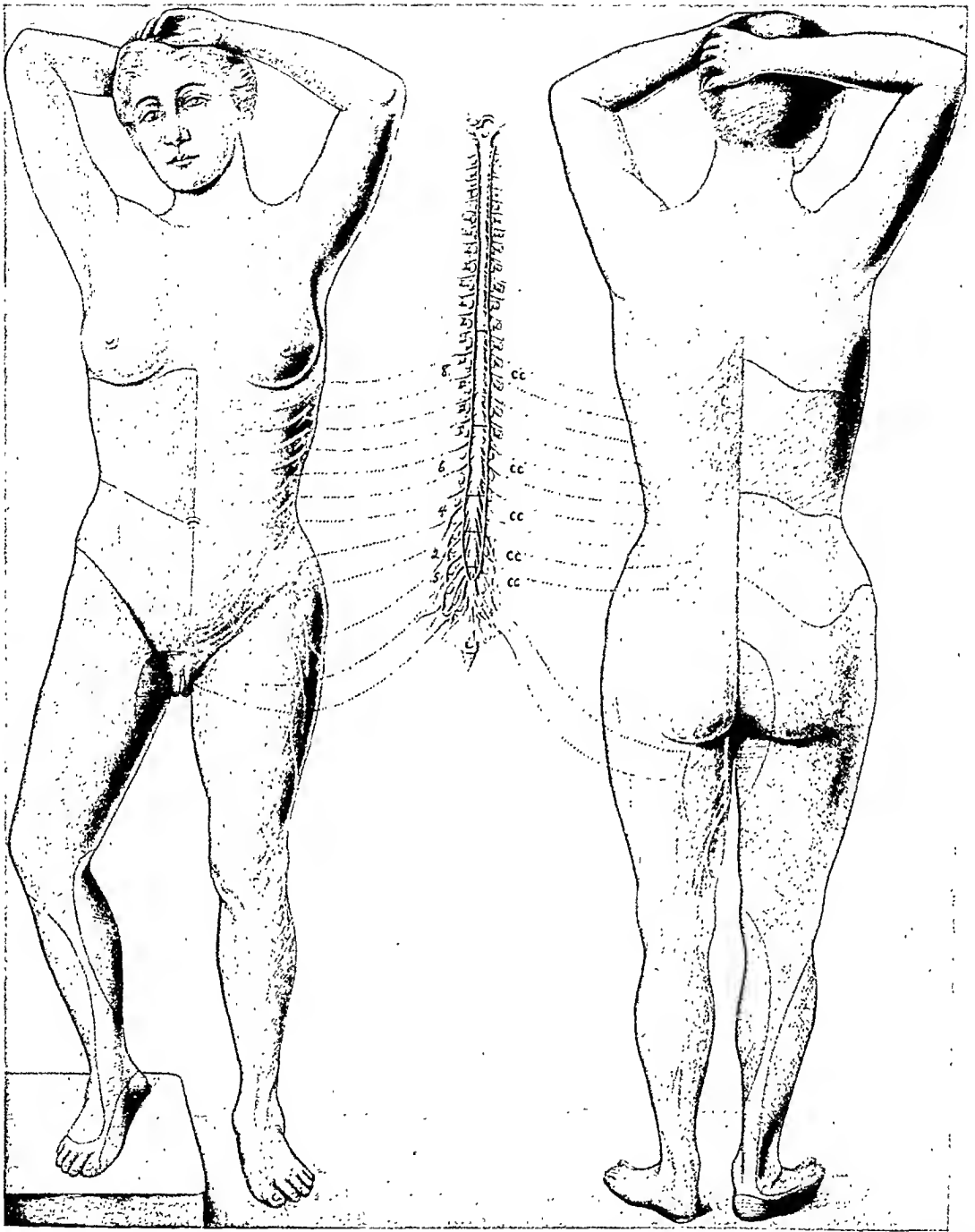
FIG. 1. A study of the capacity of the spinal canal at various heights, showing the amount of mechanical expansion of spinocain required to produce anesthesia of various regions of the body. Note the capacity of the spinal canal in cubic centimeters, as compared to the regions of anesthesia on the body surface.

were injected into dogs weighing 9 kg. (20 lbs.), convulsions occurred followed by death. If liquid alboline or olive oil was used as a solvent for the novocaine before it was injected into the subarachnoid space, satisfactory anesthesia was obtained. The duration was extended and by elevating the hips of the dog it was limited to the legs only. Anesthesia appeared to be more intense, and with the oil preparations convulsions did not occur in the 6 dogs injected and there were no other toxic reactions. The viscosity of the amyloprolamine solution acts similarly to the oils and materially reduces the toxicity of novocaine, prolongs the time of absorption and extends the duration of anesthesia. Amounts of spinocain equivalent to 400 mg. (6 gr.) of novocaine have repeatedly been used with no untoward results. In 18 cases 600 mg. were used.

We tested all the drugs that have been advocated as stimulants to the vasomotor constrictors. Strychnine, intradurally, was the only one that showed satisfactory results in the presence of novocaine. Similar tests were conducted on animals and humans both intravenously and intramuscularly, and none of the so-called stimulants proved to have any definite value, with the exception of ephedrine and suprarenine. Ephedrine and suprarenine combined, introduced intravenously proved the most effective as well as lasting. Suprarenine had no value when injected into the muscles.

These experiments enabled us to establish a ratio of the amount of ephedrine required to stabilize vascular pressure against definite amounts of novocaine, and with anesthesia at various heights on the body surface. We also learned how much ephedrine suprarenine mixture to use to cause a hypotension case to approach normal and maintain a constant pressure for from four to six hours, as well as how to minimize the dose of ephedrine in hypertension cases. Given a case of hypotension with pressure 90/60, 50 mg. of ephedrine and 0.7 mg. of suprarenine

introduced intravenously will increase the pressure to approximately 120/70, which may be relied upon for at least four hours

Fig. 2. One c.c. of the anesthetic is confined to the tip of the dura, as confirmed by the roentgen ray. Note shadow.

from the time of injection, during which time one can proceed as with a normal case. A hypertension case of 200/110 pressure, however, should not have over one-half the amount of ephedrine that would ordinarily be used in a case with a pressure over 120/70.

Bearing in mind that the vasomotor constrictors leave the cord by way of the anterior nerve routes from the second dorsal to the third lumbar vertebrae, one must estimate the amount of ephedrine to use to maintain a constant pressure. With intradural sacral anesthesia, none is required. When the lumbar nerves are bathed in spinocain and with anesthesia of the legs, 20 to 25 mg. should be used. If the anesthetic is carried to the ninth dorsal and anesthesia to the umbilicus,

30 to 40 mg. should be employed. If the solution is expanded to the sixth dorsal, and anesthesia to the unciforme, 50 to 60 mg. of ephedrine will be necessary. Strychnine intradurally stimulates the vasomotor constrictors, but will have little or no effect if injected intravenously or intramuscularly. The ephedrine will fortify the anesthetized nerves and stimulate the unaffected vasomotors if administered before the spinocain, and will stabilize the arterial pressure. (See chart.)

Ephedrine should fortify the vasomotors against the attack of the anesthetic, and to obtain the best results must be injected before the spinal tap is made. The result will be disappointing if used after the pressure has fallen and the vasomotor constrictors have become anesthetized, as it will not reestablish a normal pressure if employed at this time.

There has been considerable discussion as to the toxicity of ephedrine and two deaths have been attributed to 50 mg. doses. With an effort to estimate the maximum safe dose we used a 1:1000 solution in rats, weighing 100 gm. and by transposing our findings in proportion to a man weighing 72 kg. (160 lbs.) the lethal dose was estimated to be 13,200 c.c. (132 qts.) or 13 gm. The maximum safe dose according to Solis-Cohen and Gilhens is 5 gm. or 5000 mg. It would hardly seem possible that we would ever be called upon to approach either of these dosages.

It is interesting to note that a 100 per cent solution of novocaine amyloprolamine solution used to produce intradural sacral anesthesia in dogs caused no appreciable increase in the cell count of the spinal fluid, but that apothesine and stovaine produces a marked increase in the number of cells and not infrequently we have observed 15, 20 and as many as 25 cells to the cubic millimeter after a 5 per cent solution of the latter has been injected.

Thirty per cent of our dogs showed a transitory or permanent paralysis of the hind legs after 5 per cent stovaine solution had been introduced into the subarachnoid space. This paralysis lasted from six hours to nine days. The dog with the paralysis lasting nine days was killed to relieve his misery. All cases in which stovaine was employed showed perivascular round-cell infiltration, and by the Cajal method of nerve staining, we found the axis cylinders swollen, marked degeneration of the fibers of the anterior roots, and in a dog that was paralyzed for five days the sciatic nerve showed marked degeneration of the nerve fibers. Novocaine in 5, 10 or 20 per cent solution, on the other hand, failed to produce any macroscopic or microscopic changes. These dogs were autopsied at two, four, and five days, and 1 at the end of nine days.

The absorption time of various anesthetic agents from the spinal fluid shows a great variation. Traces of stovaine have been found in the spinal fluid twenty hours after introduction, whereas no traces of novocaine could be found in innumerable cases after four hours and in no case after six hours. In mentioning novocaine I include neocaine and procaine as they are all nearly identical, the only variation being in the manufacture of the product and not in the primary formula.

Deductions lead us to believe that novocaine is absorbed quicker by the sensory than by the motor nerves. This may possibly be due to the fact that the sheath of the motor nerves is somewhat thicker than the sheath of the sensory nerves. We are also led to believe that novocaine is absorbed by the nerve trunks and enters the system in this way rather than through the veins or lymphatics by osmosis. As has been shown, the osmotic rate between spinal fluid and the venous blood is very slow, due to the similarity of intravenous and intraspinal pressure, the former being 3 to 4 mm. Hg and the later 6 to 8 mm. Hg, with the patient in a reclining position. This may also account for the fact that if a vein is accidentally punctured during a spinal tap, bleeding does not occur into the spinal canal, but there is a possibility of seepage of spinal fluid into the vein (Fig. 3b)

Age	Operation	Anesthetic	Amount (c.c.)	Inter-space (lumbar)	Position	Blood pressure and pulse			Color	Height of Anesthesia
						Before	During	After operation		
	Tulane University, Department of Surgery, Drs. Oschsner and Garside									
54	Suprapubic cystotomy	Spinocain	2	3rd	10° Trend.	165/100 P.140	190/100P.130	180/100P.120	Normal	Umbilicus
28	Cholcystectomy	Spinocain heavy	0.75	1st	5° Fowler's	120/70 P.104	148/70 P.100	138/70 P.98	Normal	Costal margin
31	Open reduction of tibia	Spinocain heavy	2	3rd	15° Flower's	138/80 P.88	138/80 P.84	138/80 P.84	Normal	Illiac crest
	Northwestern University, Dr. G. de Takats									
48	Varicose veins	Spinocain	1.5	4th	15° Trend.	180/100 P.90	210/100P.100	185/110P.94	Normal	Interilliae line
35	Appendectomy	Spinocain	2	3rd	8° Trend.	120/75 P.84	125/80 P.88	120/70 P.80	Normal	Ensiform
56	Pelvic laparotomy	Spinocain	2	3rd	8° Trend.	180/110P.88	180/110P.94	190/115P.90	Normal	Navel
	Boston University, Department of Surgery (Boston City Hospital), Dr. W. R. Morrison									
60	Cholcystectomy	Spinocain	3	1st	Level	120/80 P.84	90/60 P.92	120/80 P.84	Noraml	Nipples
40	Perforated gastric ulcer	Spinocain	2	2nd	Flat	100/56 P.110	98/58 P.104	110/61 P.100	Normal	Costal margin
17	Appendectomy	Spinocain	2	2nd	10° Trend.	90/50 P.94	140/60 P.88	120/50 P.84	Normal	Costal margin
	University and Bellevue Hospital, Dr. M. F. Campbell*									
21	Ureterotomy	Spinocain	2	3rd	Lateral elevated	114/68 P.84	120/50 P.90	122/68 P.80	Normal	Ninth rib
40	Renal calculus	Spinocain	2	1st	Kidney	110/80 P.88	120/68 P.84	120/74 P.80	Normal	Ninth rib
78	Superpubic cystotomy, cancer of bladder, cauterization, radium	Spinocain	2	3rd	10° Trend.	216/96 P.94	178/96 P.90	212/108P.90	Normal	Umbilicus
	Long Island College Hospital, Dept. of Obstetrics and Gynecology, Dr. John O. Polak									
32	Hysterectomy	Spinocain	2	3rd	12° Trend.	150/60 P.80	120/68 P.80	110/65 P.80	Normal	Mid-epigastrium
38	Lacerated pelvic floor	Spinocain	2	3rd	10° Trend.	130/80 P.80	138/70 P.86	124/70 P.88	Normal	Costal margin
32	Hysterectomy, salpingoophorectomy	Spinocain	2	3rd	12° Trend.	134/70 P.72	124/64 P.76	140/74 P.80	Normal	Umbilicus
	Augustina Hospital, Percy Clinic, Drs. Percy and Nadeau									
58	Gastric resection	Spinocain heavy	0.5	2nd	8° Fowler's	140/70 P.96	140/80 P.84	140/80 P.90	Normal	Ensiform
38	Cholecysteetomy, appendectomy	Spinocain heavy	0.5	2nd	Flat, pillows under head and shoulders	118/70 P.105	120/70 P.100	120/55 P.100	Normal	Costal margin
20	Ankylosis of hip (T.B.C.)	Spinocain	3	4th	5° Trend.	130/65 P.92	132/65 P.80	130/65 P.76	Normal	Umbilicus
	Dr. George N. Pease, Portland, Oregon									
52	Gastroenterostomy	Spinocain	2	2nd	Level	120/75 P.84	120/70 P.88	118/70 P.88	Normal	Ensiform
60	Colosteetomy, appendectomy	Spinocain	3	1st	Level	105/68 P.80	90/60 P.94	140/74 P.84	Normal	Ensiform
56	Colosteetomy, appendectomy	Spinocain	2	2nd	Level	104/78 P.80	140/78 P.84	140/70 P.80	Normal	Ensiform

* See J. A. M. A. 91: 819, Sept. 15, 1928.

the latter possibly accounting for the frequent hypotonic headaches, as these headaches are observed more frequently after blood occurs in the spinal needle or after bungling attempts at a spinal tap.

The intrapsinal pressure with the patient in a sitting posture is greater than when the patient is recumbent, but there is no difference between the pressures of a recumbent patient and one in a 45° Trendelenburg position. This may be compensated by the cerebral congestion produced when the patient is placed in so marked a degree of Trendelenburg position. We are also inclined to believe that headaches are more likely to occur than when the spinal tap is made with the patient sitting, as with this method a greater amount of spinal fluid is permitted to escape. This is also true when large needles (as the Barker, 15 to 17 gauge) are employed. A long tapering point is likely to produce more bleeding than the short beveled fine-gauged needle.

As a result of these studies and reports on 11,000 inductions with spinocain, performed by surgeons in every state in the Union and several foreign countries, we feel justified in asserting that spinocain is controllable within the dural sac. Controllable spinal anesthesia is quite different from spinal anesthesia as it has been known in the past, in that nearly all of the objectionable features are eliminated.

The controllability of spinocain, or the heavy solution, permits of a sure, well-defined sacral anesthesia within three minutes in 100 per cent of the cases (Figs. 6, 7), thus presenting a distinct advantage over caudal anesthesia, which requires from fifteen to twenty-five minutes for anesthesia with more than 25 per cent of failures and frequently has to be supplemented by para-sacral. Another advantage is that the equipment is inexpensive and ordinarily in the possession of every physician: one 2 c.c. Luer-Lok syringe, one 3 c.c. Luer-Lok syringe, one hypodermic needle and one spinal puncture needle (Pitkin). The surgeon may also be his own anesthe-tist, a distinct advantage in small hospitals, emergency night work, or isolated practice.

Every surgeon is confronted with certain conditions in which any form of inhalation anesthesia is absolutely contraindicated, and to deal with these he should have at least a working knowledge of controllable spinal anesthesia. Tuberculosis is undoubtedly the most frequent. To administer inhalation anesthesia in this condition is almost criminal; Dr. S. R. Morrow only recently pointed out to the author several arrested cases that had been converted into active ones by the use of inhalation anesthesia. Asthmatic patients cannot take inhalation anesthesia and frequently are unable to breathe lying down. With these the heavy solution is indicated, as also in cardiac cases with broken compensation. The surgeon or anesthetist who permits or administers general anesthesia for these types of cases, or to diabetic or nephritic patients, is not giving the patient a square deal, as he knows the inhalation anesthesia will be harmful and perhaps fatal. The same statement applies to all acute chest conditions.

Acute abdominal conditions respond better to spinal anesthesia, because the sphincters are relaxed, peristalsis increased, acidosis lessened, and distention or ileus is much less likely to appear.

Spinal anesthesia is much safer in upper abdominal surgery, in that the percentage of postoperative lung complications are greatly reduced, as shown by the works of Sise, Campbell, Goodman, Boyd, Babcock and others.

In obstetrics the heavy solution offers many advantages. Anesthesia may be secured of the cervix, vagina, vulva and perineum, in fact all of those parts supplied by the sacral and pudendal nerves. Uterine contractions are not inhibited although pain is abolished. As the hypogastric plexus is not anesthetized, it causes greater relaxation of the soft parts, quicker and easier deliveries, less trauma and fewer lacerations. It offers greater protection to the mother and child.
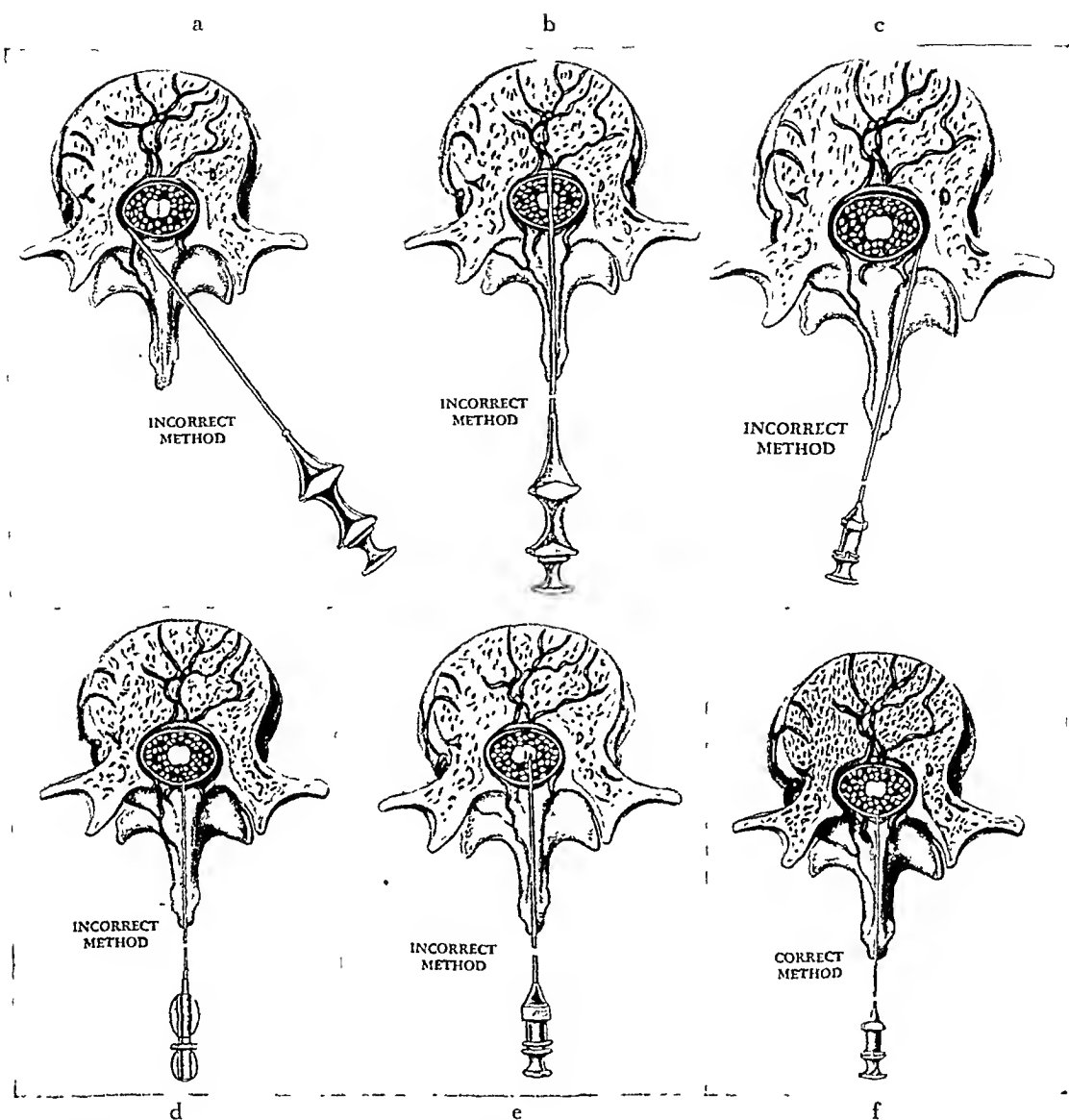
Fig. 3. a. The spinal puncture needle introduced between the laminae, the point outside of the dura. The reason for a dry or bloody tap.

b. The needle inserted through both walls of the dura puncturing a vein. The cause of a bloody tap.

c. The needle inserted in midline but deviating to the right or left, sometimes caused by a corkscrew spine. A reason for the dry tap or blood in the needle.

d. Only half of the bevel has penetrated the dura. When the anesthetic is injected some of it is deposited extradurally. Unsatisfactory anesthesia.

e. The needle penetrating one of the strands of the cauda. A cause of postoperative paraesthesia.

f. *Correct Method.* The needle introduced between the spinous processes, the point, which is of a short bevel, is wholly within the dura.
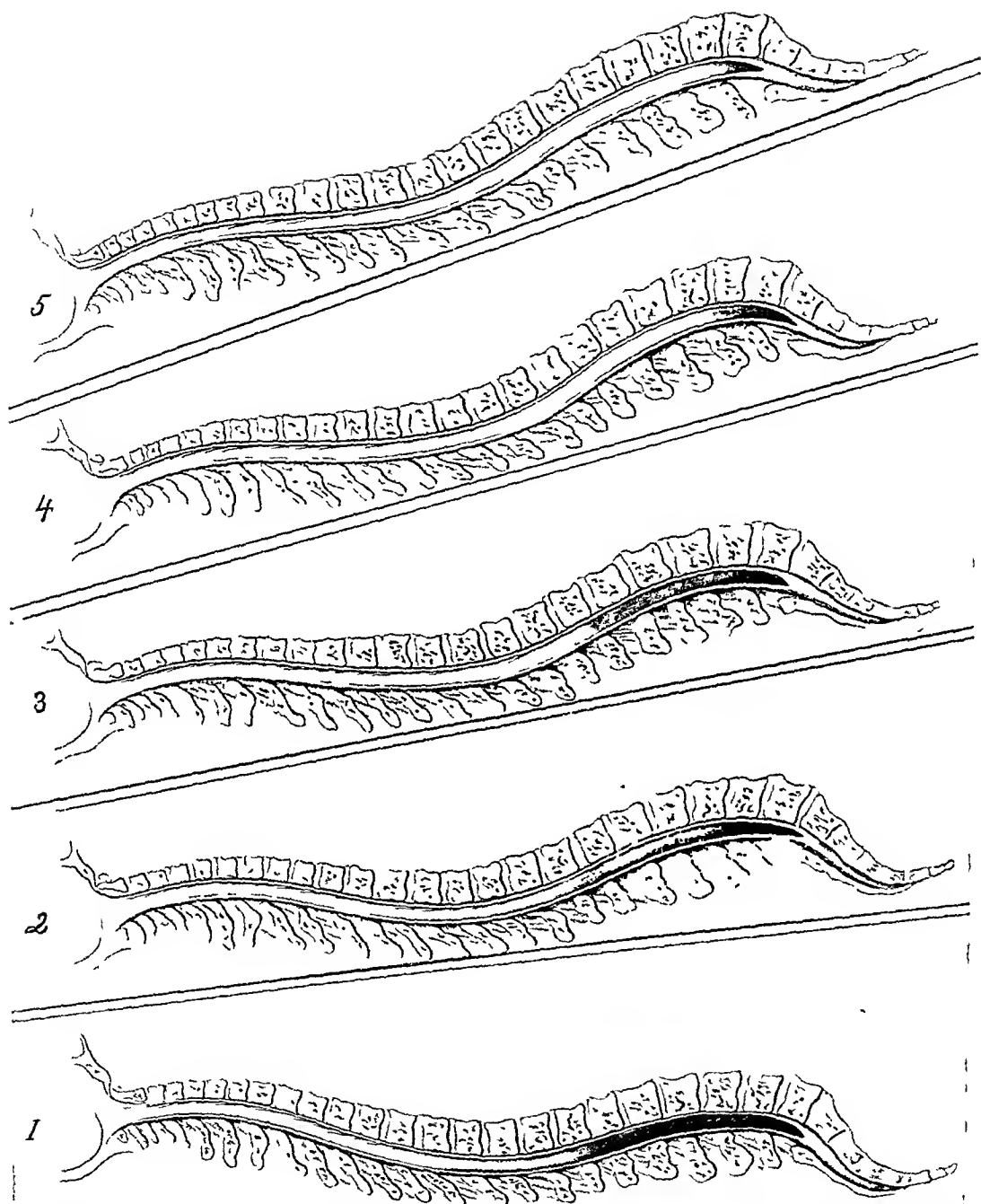
Fig. 4. 1. Table level, spinocain expanded to 8 c.c. Anesthetic to seventh dorsal. Anesthesia to costal margin.

2. 5° Trendelenburg, spinocain expanded to 6 c.c. Anesthetic to ninth dorsal. Anesthesia to umbilicus.

3. 8° Trendelenburg, spinocain expanded to 4 c.c. Anesthetic to first lumbar. Anesthesia of the legs.

4. Table 12° Trendelenburg, 2 c.c. of spinocain anesthetic to third lumbar. Anesthesia of the perineum and legs below the knees.

5. 18° Trendelenburg, 1 c.c. of spinocain. Anesthetic in tip of dura. Anesthesia of the perineum only.

The technique of using spinocain is quite different from ordinary spinal anesthesia, and any one who contemplates not complain of "that faint feeling." Fluids may be permitted before, during or after the operation.
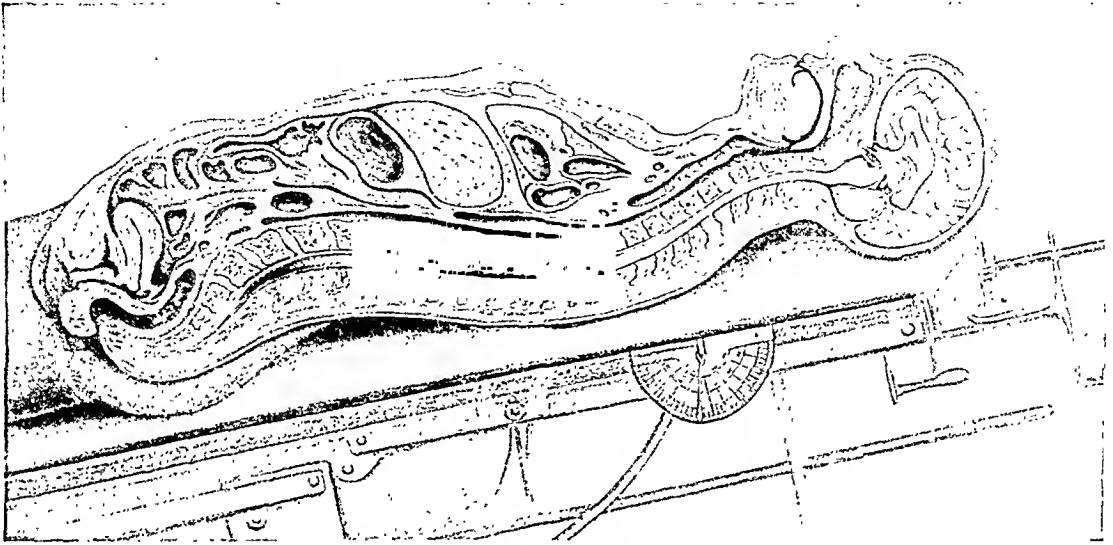
FIG. 5. The patient is in 15° Trendelenburg. The heavy solution mechanically expanded to 8 c.c. Anesthetic to the seventh dorsal, anesthesia to the unciform.

using it should thoroughly familiarize himself with the technique or, better still, visit some of the clinics where it is being used.

One rule of caution: *never administer spinocain with the patient in a sitting posture and, after the heavy solution has been used, never place the patient in a Trendelenbug position.* It must be remembered that the success one experiences with either of these solutions will be in direct ratio to the perfection of technique. Failures or complications will not be due to the solutions, but to errors at the time of administration, and the position of the patient thereafter.

The preliminary preparation of the patient may be carried out in the routine manner of the hospital. It is, however, advisable to have the bowels and bladder emptied before the anesthetic is administered to avoid soiling or wetting of the operating table.

It is not necessary to withhold fluids or light food unless the operation is to be on the stomach, as with something in the stomach these patients do better and do

TECHNIQUE

The equipment for spinocain anesthesia is simple and inexpensive:

1 Luer-Lok syringe, 2 c.c.
1 Luer-Lok syringe, 3 c.c.
1 Pitkin spinal puncture needle
1 hypodermic needle with safety guard ¾ inch
1 ampule spinocain
1 ampule ephedrine-novocaine solution
1 pair sterile gloves
1 sponge holder
1 sterile file
sponges
tincture of iodine, 5 per cent

The syringes should preferably be of an all-glass type with a suitable locking device that will permit the manipulation of the needle and syringe without fear of detachment. They should be so constructed that there is no chance of leakage or the injection of air. They should also have a locking device that will not jam or permit the needle to "blow off." One of the two syringes should hold 2 c.c. for the local ephedrine-novocaine solution and the other 3 c.c. for the spinocain or heavy solution.

The needles should be made of rustless steel. They are less apt to break, retain a sharp point longer and withstand a great

frequently occurs. Furthermore satisfactory anesthesia with this type of needle is not always secured because a portion of the
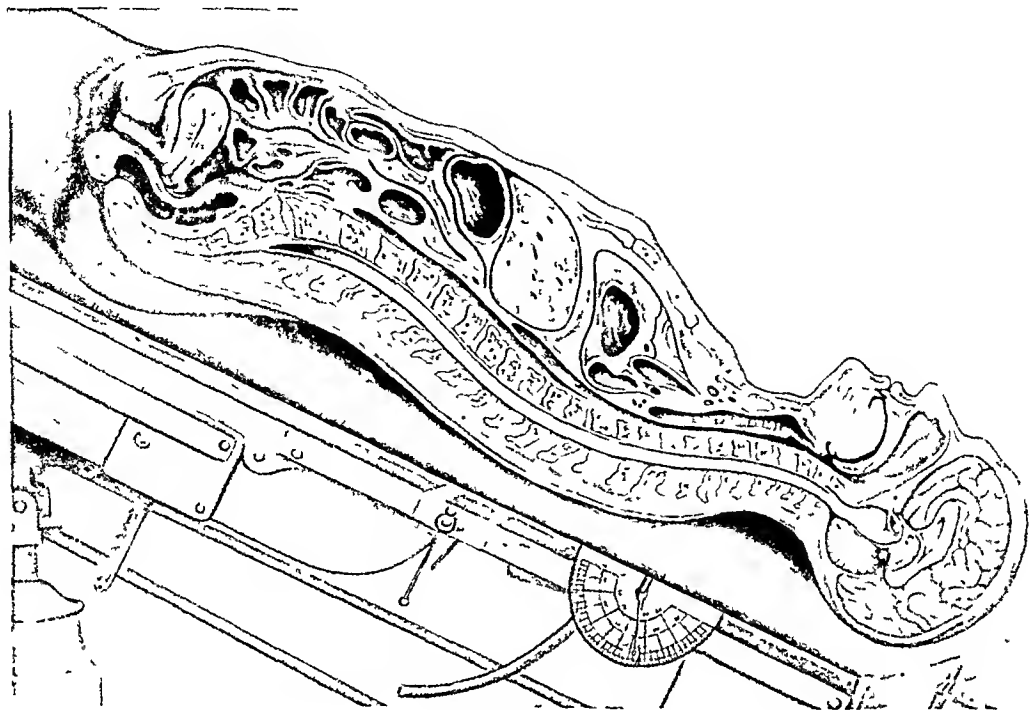
Fig. 6. The patient in 18° Trendelenburg, 1 c.c. of spinocain in tip of dura. Perineal anesthesia only.

deal of bending and manipulation. The needle for local infiltration should be of 25 or 27 gauge, sharp, and provided with a safety guard to prevent its disappearance should it break in the tissues. The spinal puncture needle should be of rustless steel, not nickeloid or nickel-plated, of 20 or 22 gauge. The smaller the caliber of the needle the less will be the trauma to the tissues and the less postoperative headache. The bevel should be of 45°, never 20° or 30°. The author's needle has a short bevel, the rear portion of which is rounded so that it cuts a miniature trap door in the dura. This opening closes by intradural pressure when the needle is withdrawn, preventing seepage of spinal fluid and the resultant backache and headache. It is inadvisable to use the large Bier needle of 15 to 17 gauge, or a needle with a long tapered point. With a large needle trauma of the soft parts is produced and with a long tapered point needle unnecessary bleeding

bevel may remain partly outside of the dura, and so some of the solution be deposited extradurally (Figs. 3, 4).

Before sterilization, the stylet should be withdrawn from the needle, which is then tested by bending it into a semi-circle, to reassure one's self that there is little possibility of breaking it in the tissues.

The ampules should be immersed in 70 per cent alcohol to sterilize them. Before using, the neck of the ampule should be nicked with a sterile file and then broken off with the fingers, protected with gauze or a towel. The contents of the ephedrine-novocaine ampule are drawn into the 2 c.c. syringe and the spinocain or heavy solution into the 3 c.c. syringe.

One hour before the operation the patient should be given an injection of morphine sulphate 16 mg. (¼ grain) and scopolamine 0.4 mg. (1/150 grain). While this in no way intensifies the anesthesia it allays fear and apprehension. In extremely

nervous individuals the dose of morphine may be increased to 20 mg. (⅓ grain) or an additional amount of 16 mg. of morphine may be administered five hours before operation.

Spinocain has a much lighter specific gravity than spinal fluid and will ascend rapidly in the spinal canal if the upper part of the patient's body is raised. *Spinocain should never be given to the patient in a sitting position.* The heavy concentrated solution is much heavier than the spinal fluid and should be administered only with the patient sitting or in a Fowler's position.

The paramount thought and endeavor should always be never to hurt the patient at any time. A patient once subjected to one painful manipulation may lose faith in the method and the ability of the operator. Lost confidence is hard to regain and may be the direct cause of an unsuccessful anesthesia. To be successful with spinal anesthesia the technique should be developed to such a finesse that the patient is never subjected to pain and is carried through the operation in a happy and cheerful frame of mind.

Before proceeding with the injections it is advisable to place the equipment and the syringes filled with their respective solutions on a sterile table in easy access to the operator.

The spinal puncture and injection of spinocain should always be done with the patient lying on the side with the knees flexed upon the abdomen, the head bent forward and the back bowed out. This position separates the spinous processes and puncture may be made easily and painlessly. The shoulders and hips should be in a vertical line. If the shoulders are tilted and the hips vertical, or the hips tilted and the shoulders vertical, a "corkscrew spine" is produced, which presents difficulties at the time of puncture (Fig. 3c).

If a right-sided operation is to be performed the patient should be placed on the left side, as spinocain is of a lighter specific gravity (1.0005) than spinal fluid; it floats on the spinal fluid and anesthetizes the

nerves of the right side first (Fig. 8). For a left sided operation the patient should be placed on the right side. Where median
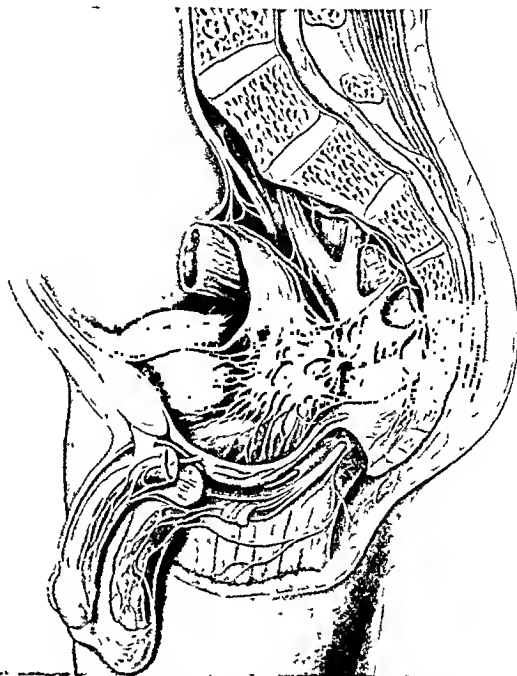
Fig. 7. With intradural sacral anesthesia, only the pudendal and sacral plexuses are anesthetized. A schematic study of the branches and parts supplied by the above nerves. The hypogastric plexus that supplies the fundus of the bladder is not anesthetized.

incisions are to be made there is no choice The head of the table should be lowered so as to place the patient in a 5° Trendelenburg position. This is hard to estimate, but easily measured with the tiltometer (Pitkin).

The heavy concentrated solution is of much heavier specific gravity (1.109) than spinal fluid and will immediately gravitate to the dependent parts of the spinal canal. *The heavy solution should always be given with the patient sitting or in a Fowler's position. After administration the patient should never be placed in a Trendelenburg position.*

With the patient in position the skin over a wide area extending from the fifth or sixth dorsal vertebra to the sacrum is painted with a 3 to 5 per cent tincture of iodine, then by palpating along the lumbar spine from the twelfth dorsal to the sacrum

a wider interspace will be found, which is selected for the point of puncture. By firm pressure with the thumb nail of the gloved

Before proceeding with the spinal puncture a cutaneous wheal is raised with one-half of the contents of the ephedrine-novo-
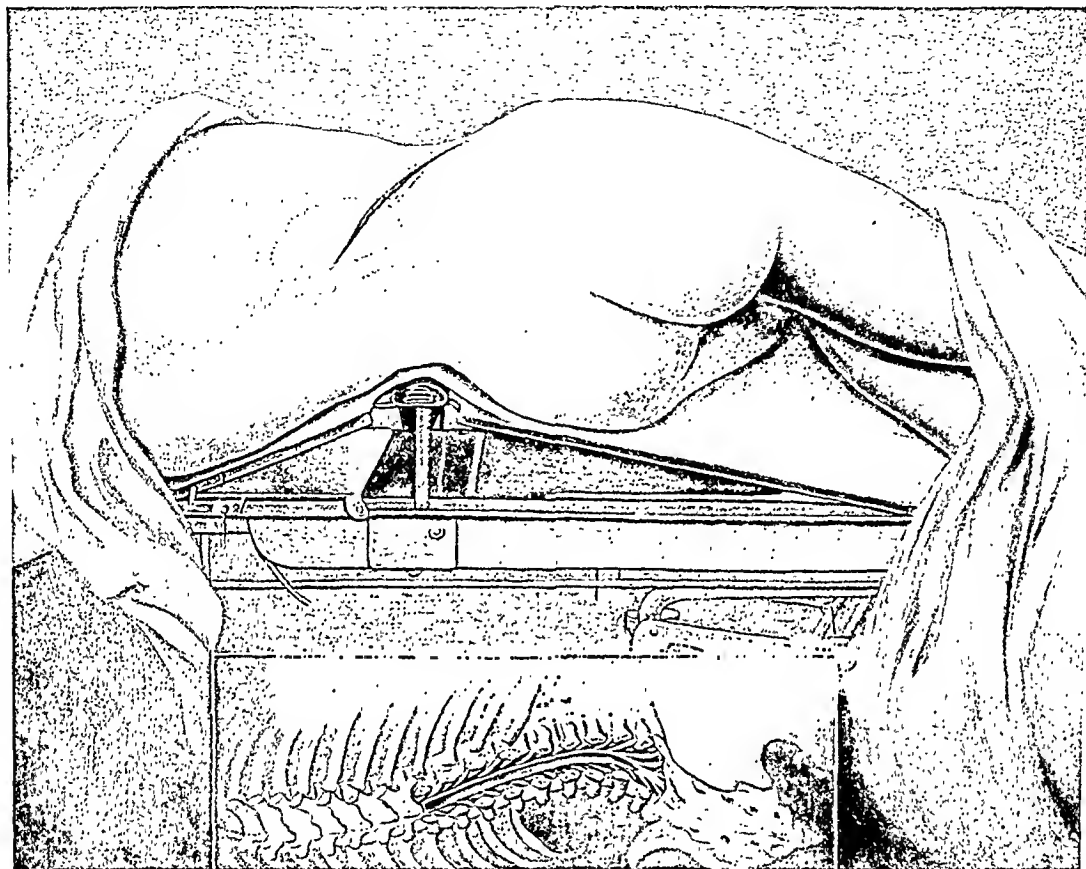
Fig. 8. Spinocain is more effective in kidney work, because of its lightness. It ascends to the crest of the spinal canal, when the body is lifted by the kidney bar and produces a more intense anesthesia at the site of operation.

hand, a mark is left on the skin which is easy to find when the wheal is to be raised.

The interspace selected for the site of puncture is not of material importance, as the extent of anesthesia is regulated almost entirely by the degree of Trendelenburg or Fowler's position employed, and by the amount of mechanical dissemination of the solution, purposely effected by mixing either solution with the spinal fluid. *To secure satisfactory anesthesia spinal fluid should be aspirated into the syringe and mixed with the anesthetic solution before any attempt is made at injection.*

For stomach and gall-bladder operations a quicker anesthesia will be obtained if the first lumbar interspace is selected.

caine (ephedrine 50 mg., novocaine 10 mg., distilled water ad q.s. 1 gm.) ampule, using a fine hypodermic needle as described. Without withdrawing the needle it is carried directly into the interspinous ligament, while the other half of the solution is injected as the needle advances. By projecting the solution ahead of the needle the latter enters freshly anesthetized fields. In other words the thumb proceeds faster than does the needle. The spinal puncture may be made without pain by inserting the lumbar needle through the center of the wheal. In penetrating the interspinous ligament care should be taken that the needle is at right angles to the long axis of the spine. Never attempt the puncture

between the laminae (Fig. 3a). Avoid inserting the needle in an upward direction or at an acute angle to the spine. Do not deviate to the right or left (Fig. 3c). The veins about the cord which are large and numerous may be avoided when the puncture is made as recommended. Unnecessary bleeding will occur if the puncture is attempted between the laminae, with the needle at a tilt, or with a needle of large caliber or with a long tapering point. When the dura is punctured there is a slight snap, which is recognized after the first few punctures, and the needle encounters less resistance. Avoid the point of the needle piercing the opposite side of the dura or coming in contact with the body of the vertebra.

When the dura has been entered the stylet is removed and spinal fluid should flow through the needle. If no spinal fluid appears rotate the needle on its own axis and if there is no flow insert it deeper. If bony resistance is felt (the body of the vertebra) the needle has undoubtedly been deviated or inserted too deeply (Fig. 3b). In that event is should be withdrawn to the skin surface and reinserted at a slightly different angle. Always have the stylet in place when making manipulations. Occasionally the first drop or two of spinal fluid will contain blood. When bleeding ceases the injection may be made. If it persists, the needle should be withdrawn and reintroduced. The injection of the anesthetic solution should never be made until clear spinal fluid flows through the needle, as this is the only assurance that its point is within the dural sac. Unless the solution is injected into the subarachnoid space anesthesia will not occur.

When anesthesia of the perineal region is desired only 1 c.c. of spinocain is required Attach the 3 c.c. syringe containing 1 c.c. of spinocain to the spinal puncture needle, aspirate one or two drops of spinal fluid to reassure yourself that the needle has not been misplaced, then inject the contents of the syringe, immediately placing the patient in a 15° to 18° Trendelenburg position as measured by the tiltometer (Fig. 6).

If anesthesia is to be confined to the legs 2 c.c. of spinocain is used. Aspirate 1 c.c. of spinal fluid into the syringe containing
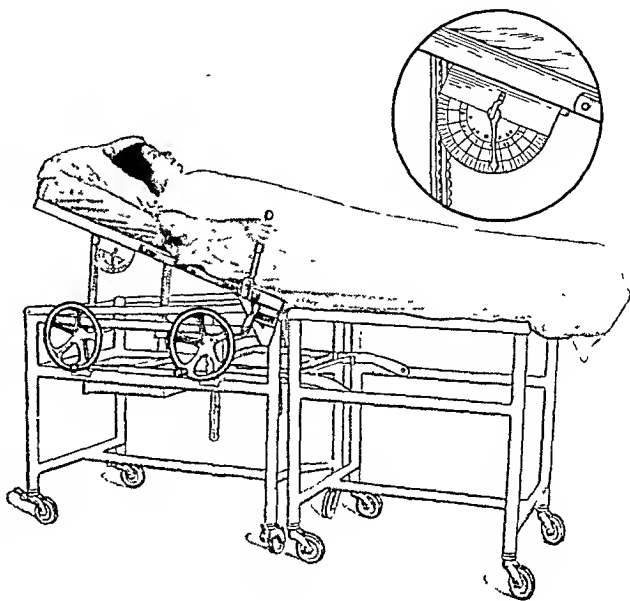
FIG. 9. Obstetrical position.

the anesthetic solution, and then inject one-half the contents. Again aspirate 1 c.c. of spinal fluid and inject the contents of the syringe. This amount will be sufficient to bathe all of the lumbar nerves. The table is now placed in a 10° to 15° Trendelenburg position (Fig. 4).

For anesthesia to the umbilicus 2 c.c. of spinocain is sufficient for short operations. For prolonged operations 2.5 to 3 c.c. should be employed in ratio to the anticipated length of the operation. Into a 4 c.c. Luer-Lok syring aspirate 1 c.c. of spinal fluid; inject one-half the contents. Again aspirate 2 c.c. of spinal fluid and inject the contents of the syringe, placing the patient in a 7° to 10° Trendelenburg position.

To extend the anesthetic to the sixth or seventh dorsal vertebra and anesthesia to the costal margin, draw up 3 c.c. of spinocain into a 4 c.c. Luer-Lok syringe, aspirate 1 c.c. of spinal fluid, inject one-half the contents, again aspirate 2 c.c. of spinal fluid, inject one-half the contents of the syringe and repeat this once again to make a total expansion of 8 c.c.; then inject the contents. Then place the patient in a 5° Trendelenburg position.

To produce intradural sacral anesthesia with the heavy solution have the patient sit up on the table, the back bowed outward, the elbows resting on the knees, and the head bent forward with the chin on the chest. Palpate along an imaginary line between the crests of the ilia to locate the fourth lumbar interspace. Insert the spinal puncture needle as described. Aspirate 1 drop of spinal fluid to reassure yourself that the needle is in place and inject 0.5 c.c. of the heavy solution. Permit the patient to remain seated from three to four minutes to allow the anesthetic to become fixed. Then place the patient in a Fowler's position of 15° to 18° or reverse Trendelenburg. To secure anesthesia of the legs aspirate 2.5 c.c. of spinal fluid into the syringe containing the 0.5 c.c. of heavy solution, and inject the contents. Immediately place the patient in a 12° to 15° Fowler's position. To secure anesthesia of the upper abdomen the patient should be placed on the side as described for the use of spinocain, but in a 10° to 12° *Fowler's position*. Into the syringe containing 0.75 c.c. of heavy solution aspirate 3 c.c. of spinal fluid. Inject one-half the contents of the syringe and again aspirate 2 c.c. of spinal fluid; inject the contents of the syringe. Keep the patient in an 8° to 10° Fowler's position or elevate the head and shoulders with pillows. Luer-Lok syringe. This will carry anesthesia to the costal margin (Fig. 5). The heavy solution is not adaptable for operations in the pelvis or lower abdomen, unless the patient suffers from an asthmatic or cardiac condition and cannot breathe in a recumbent position. Ordinarily spinocain and a Trendelenburg position offer more advantages in this field. After the injection has been made withdraw the spinal puncture needle and cover the punctured wound with collodion and cotton or a small square of adhesive plaster.

Turn the patient on the back and immediately adjust the table to the degree of Trendelenburg or Fowler's position indicated. The line of anesthesia can be sharply defined by familiarity with the technique, by accuracy as to the extent of expansion of the spinocain preparations, and by accurately determining the degree of Trendelenburg or Fowler's position as measured by the tiltometer.

If for any reason the aspiration and mixing cannot be accomplished satisfactorily the head of the table may be raised temporarily to allow the spinocain to ascend in the spinal canal, or lowered if the heavy solution has been used, but as soon as anesthesia is obtained at the desired point the patient should be placed in the Trendelenburg or Fowler's position as described. If this procedure is to be employed the patient must be watched constantly and tested for anesthesia.

The ephedrine in the 1 c.c. ampules is sufficient to maintain blood pressure providing the anesthetic does not extend above the sixth or seventh dorsal vertebra. If due to carelessness or improper technique, more of the vasomotor constrictors are anesthetized than should be, the ephedrine is not sufficient to overcome the vascular depression that will ensue.

Heavy and light solutions are almost as old as spinal anesthesia. In fact there is nothing new about regulating the specific gravity of the various solutions used for spinal anesthesia, but no means has previously been attempted to overcome the toxicity of anesthetic agent. It has been definitely proved that amyloprolamine and propantriol not only produce viscous solutions that prevent dissemination and mixing with the spinal fluid, but they also reduce the toxicity of novocaine, permitting three and four times as much to be used without harm. They also tend to stabilize the degree of anesthesia and prolong its duration.

Spinocain has been taken up as a routine anesthetic by innumerable operators, who have tried various other forms of spinal anesthesia and abandoned them as unsafe.

The revived enthusiasm of spinal anesthesia can hardly be estimated. An idea of

the interest that has recently been shown in spinal anesthesia was very well demonstrated at the annual meeting of the American College of Surgeons in Boston, and at the Tri-State Convention in Atlanta as at both of these conventions spinocain seemed to be the one topic of conversation and clinics where this method of anesthesia was employed were crowded to capacity.

Never attempt to introduce a spinal puncture needle above the conus medullaris, as it has been definitely shown that the injection of tropacocaine, novocaine and stovaine into the spinal cord will cause immediate death with typical medullary symptoms. The results were constant even with diminished doses of the drugs. This has been shown not to be a mechanical reaction but a toxic one as physiological salt solution failed to produce any recognizable effects. A review of a number of cases where sudden death occurred immediately after the injection showed conclusively that this rule had not been adhered to. The author had the occasion to witness one of these in a Boston Hospital within the last two months.

Injections should never be made outside of the lumbar spine, the height of anesthesia to be regulated by the amount of mechanical expansion of the solution.

Some time ago the author made the statement that within ten years conduction anesthesia, including spinal, would supersede inhalation anesthesia in popularity. This seems to be materializing even sooner than was anticipated. Three of our leading universities are teaching spinal and conduction anesthesia. How soon will it be before all of our medical schools will be compelled to fall in line?

As a last word of warning do not attempt the use of this form of anesthesia until you are thoroughly familiar with the technique and the physiological actions of the solutions.

SPINAL ANESTHESIA

WITH SPECIAL REFERENCE TO ITS USE IN SURGERY OF THE HEAD, NECK AND THORAX*

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BROOKLYN

THE purpose of this paper is to describe a technique for safely producing surgical anesthesia of the entire body by the injection of an anesthetic solution into the spinal subarachnoid space. In my clinic, in a general surgical service, spinal anesthesia has been used almost exclusively for the past three and one-half years in all cases needing operations on structures below the diaphragm. The only exceptions have been where the anesthesia was needed for such a short period as to make it not worth while, e.g., ambulatory cases needing incision, drainage of fingers, abscesses, etc.

Our method, in brief, consisted of a spinal puncture between the second and third lumbar vertebrae, the withdrawal of 4 c.c. of cerebrospinal fluid into an ampule containing 0.1 gm. of neocaine, thorough mixing to produce rapid solution and then reinjection of the cerebrospinal fluid containing the dissolved drug. We found that this procedure gave surgical anesthesia almost up to the level of the nipples and allowed any operative procedure on all structures below the diaphragm.

During this three and a half year period over 3500 cases were operated upon and our experience with it leads us to feel that it is far superior to any other form of general anesthesia. As yet we have not found any contraindications to its use. Patients in very early childhood and advanced age tolerate it as well as young adults. Individuals with endocardial and myocardial changes, with renal diseases, respiratory diseases and metabolic disturbances are particularly suited for this type of anesthesia. It is particularly indicated in patients requiring multiple operations, e.g., women in whom it is necessary to do a cholecystectomy and appendectomy and then perhaps some form of suspension and perineal repair. Its particular advantage is that this type of anesthetic intercepts all impulses originating at the operative field and bound for the cerebrum, thus differing from all inhalation anesthetics. Crile showed that the latter allow impulses to reach the brain where they produce chromatolysis of the cells, thus adding to the cerebral shock of the operation.

Occasionally in doing multiple operations such as those just described the spinal anesthesia alone did not last long enough to allow for completion of the entire procedure and it was found necessary to finish under gas-oxygen-ether. The addition of the general anesthesia was very unsatisfactory and we began to search for a method of prolonging the spinal anesthesia. We began by gradually increasing the dose of anesthetic substance injected into the subarachnoid space and we found that the anesthesia was prolonged slightly. When the dose was doubled, we prolonged the anesthesia almost 100 per cent. The increase in the dosage was accomplished in two ways: (1) At first instead of using 0.1 gm. of the crystals we used 0.15 gm., and dissolved that in the same amount of cerebrospinal fluid as had been used in the smaller dose, namely, about 4 c.c. This gave anesthesia lasting from one hour and a quarter to two hours. Subsequently, we increased the dose in the same manner to 0.2 gm. with perfect safety to the patient and a corresponding prolongation of the anesthesia. (2) The method of adding the crystal content of one ampule to that of another ampule before extracting the cerebrospinal fluid was somewhat cumber-

some so the second method was evolved: Each ampule containing 0.1 gm. was used as a separate receptacle for 4 c.c. of cerebrospinal fluid, the latter acting as the solvent for the contained anesthetic. The combined amount of solution, namely, 8 c.c. of cerebrospinal fluid in which 0.2 gm. of the anesthetic were dissolved, was reinjected into the spinal subarachnoid space and the operation begun.

During the course of the operation the patient asked for some water which he was allowed to drink. A complaint that he could not feel the water passing through his pharynx stimulated us to test out the level of the anesthesia of this particular individual and we found, much to our surprise, that it extended upward over the entire body, including the scalp. Upon further questioning the information was elicited that although the patient knew that the fluid was passing down into his gullet, he could not feel it in the pharynx. Repetition of the method in other patients confirmed the original observation that anesthesia of the entire body was produced. Since that time, we have used this method for operating on all parts of the body above the diaphragm, for such conditions as empyema, carcinoma of the breast, diseases of the thyroid, tumor of the tongue, operations on the scalp and skull. We have also used this form of anesthesia experimentally in the last 200 laparotomies for the purpose of testing the efficacy of the method. The level of anesthesia was determined by piercing the forearm, ear lobe and skin of the forehead with a needle (Fig. 1). In all of these cases the test demonstrated complete surgical anesthesia. In none of these cases have untoward effects been noted. Contrary to the hitherto generally accepted idea of the effects of anesthetics on the upper portion of the spinal cord and medulla there have been neither respiratory nor cardiac embarrassments. Apparently the anesthetic solution affects the sensory roots at the upper portion of the cord and also the bulb. How else could the anesthesia be explained? Yet, why no serious cardiac or respiratory failure?

TECHNIQUE

Serious consequences might possibly follow the wholesale adoption of this form

FIG. 1. Illustrating the criteria by which anesthesia of the head is determined experimentally in cases where abdominal operation was performed. Needles are shown piercing the ear-lobe, the skin of the forehead and the cheek.

of anesthesia because of individual modifications of the technique that will occur until more is known of the direct effect of the anesthetic solution on the upper cord and bulb, and also until it has been determined in what concentrations the solution diffuses to those levels, and what factors modify such diffusion. Therefore, all the steps of the procedure shall be described carefully so that our technique may be followed with ease and with safety, and all the facts shall be stated accurately without extravagant claims for the method.

We use the prone position for the spinal puncture. It is more comfortable for the patient, it yields more accurate cerebrospinal fluid pressure readings, and an uncooperative individual can more easily be controlled. The sitting position is used only in severe scoliosis or extreme obesity where the median line of the back cannot be determined in the lateral position.

All patients over sixteen years of age receive a preliminary hypodermic of $\frac{1}{4}$ grain morphine sulphate and $\frac{1}{150}$ grain atropine sulphate. They are placed on the operating table in the lateral prone position and an assistant secures flexion of the trunk by approximating the head and the knees.

Since cooperation of the patient is not always procurable it is wise to be prepared to maintain the trunk flexion while the

lumbar vertebrae. The thumb of the same hand (after the fingers determine the crest) locates the depression above the imaginary
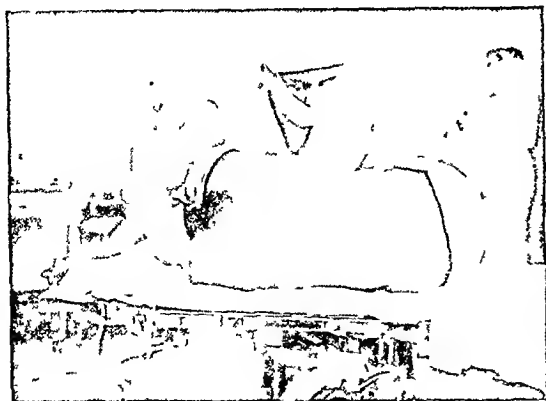
FIG. 2.

FIG. 3.

FIG. 2. Illustrating the method of insuring cooperation of the patient during administration of the anesthetic. Besides complete flexion of the trunk obtained by approximating the head and lower extremities, fixation of the extended upper arm in the axilla of the assistant assures absolute immobility of the patient.

FIG. 3. With the fingers of the left hand on the iliac crest and an imaginary line joining the superior limit of each crest running between the third and fourth lumbar vertebrae, the thumb locates the depression above. This corresponds to the interspace between the second and third lumbar vertebrae which marks the injection site.

spinal puncture is being done. It is possible for an individual of average strength to maintain such flexion easily in an uncooperative patient by applying a well-known wrestling principle. With the patient on the left side, the head approximating the knees, and the arms extended overhead, if the assistant stands on the side of the table facing the patient, places his right arm around the neck and his left arm around the knees, both from behind forward so that the hands can be clasped in front of the patient, the latter is rendered helpless (Fig. 2). The important feature beside clasping the hands is to be certain that the patient's arms are extended overhead.

The exposed portion of the back between the sacrococcygeal junction and the lower dorsal spine is painted with picric acid (6 per cent in 60 per cent alcohol) and a sterile towel is placed over the side of the patient above the sterilized field so that the crest of the ilium can be located by the operator with the fingers of one hand. An imaginary line between the superior part of both iliac crests crosses the spinal column between the third and fourth

line, that is, the interspace between the second and third lumbar vertebrae (Fig. 3). At this point the puncture is made.

Certain anatomical facts are worthy of mention at this time. For a more detailed description reference should be made to any of the standard textbooks of anatomy. The details herein contained are given solely because unfamiliarity with them is frequently conducive to failure in tapping the subarachnoid space. Many failures to procure surgical anesthesia by spinal injection hitherto reported in the literature are fundamentally due to unsuccessful spinal taps. So, also, are many of the so-called "dry taps."

The base of the spinous process of the second lumbar vertebra is comparatively thicker than the others and this is regularly felt in locating the interspace between the second and third, namely, the injection site. The axis of the interspace between the lumbar spinous processes varies. That between the fifth and fourth lumbar is almost horizontal, whereas that between the vertebrae above is very slightly upward and forward. The distance between the bodies and spinous processes of the second

and third lumbar vertebrae is great enough to allow a needle introduced horizontally in the median line between the bases of

pia by a relatively large space, the subarachnoid space. This latter space, which attains its greatest dimensions at the lower
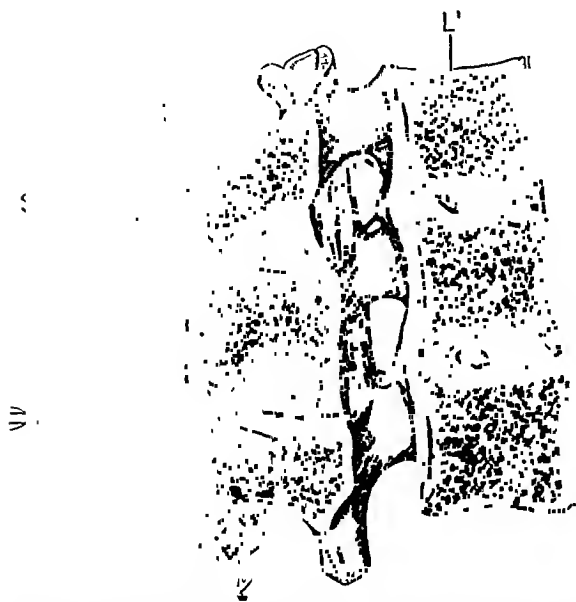
FIG. 4. Sagittal section of the lumbar spine showing the direction of the needle which is perpendicular to the surface of the skin (Labat).

FIG. 5. Cross-section between the second and third lumbar vertebrae showing the needle in the correct plane.

the two spinous processes to enter the subarachnoid space without impinging on any bony parts (Fig. 4).

Attached to the base of each spinous process is the supraspinous ligament. Between each spinous process (running from one to another) are the interspinous ligaments and along the posterior wall of the spinal canal extends the ligamentum subflavum. Each of these can be felt by the penetrating needle, and the last is a dependable guide to the depth of the needle-point. Several trials enable one to identify the ligament easily by its characteristic resistance to the passage of the needle.

The spinal dura is continuous with that which invests the brain. It is a loose sheath, unattached to the bony framework of the spinal canal and is separated from it by loose areolar tissue containing a plexus of veins. The latter are more numerous in front and on the sides. Very few are found posteriorly. The arachnoid, separated from the dura by a slight interval, the subdural space, is separated from the underlying

part of the spinal canal, contains cerebrospinal fluid.

The spinal cord terminates opposite the lower border of the first lumbar vertebra (opposite the third lumbar vertebra in the child). The lower spinal nerves between the first and second lumbar vertebrae, gathered into a bundle on either side of the filum terminale, pass down to form the cauda equina. The motor roots lie in front and the sensory roots lie behind. They are separated by an irregular cribriform membrane, the downward prolongation of the ligamentum denticulatum.

The needle is introduced horizontally in the median line through skin, subcutaneous tissue, supraspinous and interspinous ligaments, the ligamentum subflavum, the dura, arachnoid and, finally, into the subarachnoid space. It may be necessary occasionally to tilt the needle slightly upward. This necessity arises only when incomplete body flexion is secured. If the needle is introduced horizontally in the median plane of the body, cerebrospinal

fluid will be obtained at a depth of from 4.5 to 5 cm. (Fig. 5). If the needle is introduced through the skin at an angle, the distance from the median plane becomes greater as the penetration increascs. Therefore, although the introduction through the skin may be in the median plane, the needle may be 1 or more centimeters lateral to the spinal canal at a depth of 5 cm., and a so-called "dry tap" be obtained

When the needle is known to have entered the subarachnoid space, the stylet is withdrawn and cerebrospinal fluid is allowed to flow into and fill the globular portion of the ampule containing the crystals of neocaine. Between 3.5 and 4 c.c. of fluid are required. If the proposed operation is a short one (lasting less than forty-five minutes) and involves structures below the diaphragm, an ampule containing 0.1 gm. of the drug is sufficient. If the procedure is to extend over three-quarters of an hour but less than two hours and the site of operation is below the diaphragm, 0.2 gm. neocaine dissolved in 4 c.c. of cerebrospinal fluid is adequate. When, however, the operation involves the upper portion of the trunk or head, 0.2 gm. should be dissolved in 7.5 to 8 c.c. of cerebrospinal fluid. Since the ampule containing 0.1 gm. holds only 4 c.c. of fluid, it is necessary to fill two ampules.

The filled ampoules are placed on a sterile surface and the fluid drawn back and forth into a syringe to insure complete solution. This occurs readily. The entire solution (4 or 8 c.c., depending upon the duration and level of anesthesia) is drawn into a syringe. The needle used in emptying the ampule is discarded, the stylet of the spinal-tap needle is removed, and the syringe is fitted to the latter. The fluid is then injected under the force and at the rate of an ordinary hypodermic injection. The force and rate are the same irrespective of the level or duration of anesthesia desired. After the injection is completed the needle (with the syringe still attached so that no fluid is lost) is sharply

withdrawn. The patient is immediately placed in whatever position is necessary for operation. At this time, it is of paramount importance that the head be placed at a lower level than the trunk. If the dorsal recumbent position be used, Trendelenburg inclination of about 8 to 10 degrees is adequate. If the operation involves the exposure of a kidney angulating the table under the loin accomplishes the same end.

OPERATION

The field of operation is then prepared by proper sterilization and draping. As soon as this is accomplished it will be found that the anesthesia is complete, so that the operation may be begun. If any doubt exists in the mind of the operator regarding the possibility of proceeding with the incision the patient should be questioned regarding the sensations coming from the feet. The reply that they are numb or tingle is confirmation of sufficient anesthesia to begin operating.

At first pain sensation is abolishcd; but sensitive patients know that the operative field is being invaded because pressure sense remains. Shortly afterward (within three minutes) the pressure sensation also disappears. The patient, then, is not conscious of any impulses originating from the site of operation.

As the incision is made through the soft parts it is commonly noted in these cases that there is less bleeding than is encountered with other forms of anesthesia. This is readily explained by the drop in blood pressure which usually occurs a few minutes after the subarachnoid injection. The muscles are markedly relaxed so that little retraction is necessary. If the operation be upon an intra-abdominal organ, one is impressed by the completeness of the relaxation of the intestines. Instead of protruding from the wound and necessitating the use of restraining laparotomy pads with the attendant peritoneal trauma, the bowels fall back from the wound area so that elevation of the wound

edges by gentle upward retraction allows inspection of an extensive field in the abdomen. The volume of space which the intestines normally occupy is now considerably diminished because the anesthesia produces marked contraction of the intestinal wall as a result of splanchnic inhibition with consequent vagal preponderance. This aids inspection of the cavity. When this condition is contrasted with that generally found under ether narcosis, namely, marked distention of the bowel; the difference is truly striking.

In a considerable number of cases, shortly after the operation is begun, vomiting movements occur. These are quite distressing, lasting but a short time (rarely more than two minutes) and then relaxation is complete again. The respiratory excursion of the diaphragm becomes regular, slow and diminished in amplitude. This results in decreased excursion of the abdominal viscera. Consequently, abdominal surgery technically is considerably simplified.

Occasionally, within five or ten minutes after the spinal injection, involuntary defecation occurs as a result of the violent intestinal movements. Where a rectal operation is to be done the bowel should be thoroughly emptied the day before. If this is not done, the operative field may be kept clean by introducing a gauze plug into the rectum. The relaxation of the anal sphincter encountered under this form of anesthesia is never equalled except in death. This relaxation is a great aid in anal and rectal operations.

MORTALITY

Is the anesthesia safe? We have not as yet had a fatality directly attributable to the anesthesia. One patient who expired on the table was a man of sixty-seven operated on forty-eight hours after the onset of acute intestinal obstruction which operation disclosed to be due to an annular carcinoma of the cecum. He was so dehydrated and so highly toxic that only with reluctance, and because of the minimizing effect of

spinal anesthesia on operative trauma, was the operation undertaken. Another death occurred in a highly toxic diabetic patient of sixty-two with a rapid spreading gangrene of the foot and leg. During the course of a guillotine operation at the middle third of the thigh, his pulse suddenly became imperceptible and stimulation failed to restore the circulation. Another fatality occurred in a child of six. She had been treated with ice-bags at home for a supposed appendicitis and the abdomen was sectioned three days after the onset of the illness on a provisional diagnosis of obstruction. At this time she was thoroughly dehydrated, highly toxic and but a degree removed from morbidity. At operation a Meckel's diverticulum was found to have caused complete obstruction and gangrene of about 4 feet of small intestine. During the resection her life ebbed out. The fourth death occurred in a woman aged fifty-two who had been bedridden for three years because of a severe myocarditis with several attacks of decompensation and who came to operation for a suppurative appendicitis with localized suppurative peritonitis of three days' duration. Appendectomy was done, drainage was instituted, and the wound closed. After the dressings were applied, and as the patient was about to be transferred to the stretcher for transportation from the operating room, she ceased to breathe suddenly and the heart beat became imperceptible. The wound was opened quickly and trans-diaphragmatic massage of the heart instituted. Intracardiac stimulation and artificial respiration failed, however, to prevent death.

The details of these 4 cases are cited so that clinically the cause of death might be checked as far as possible, no autopsies being obtained. In each instance the patient was highly toxic, and with the exception of the third case, there was marked anhydremia. All 4 were very poor operative risks and in those with intestinal obstruction the operation would probably not have been undertaken had it not been

believed that the spinal anesthesia would be an ally rather than a deleterious factor. It is noteworthy that death did not occur as a frank accident in any of the elective cases operated upon. Out of the entire series, comprising almost 3500 cases, at least 2000 were of the elective variety. It is our belief that death would have occurred at least as certainly under any other form of anesthesia. Nevertheless, these 4 fatalities are reported as possibly having been contributed to by the spinal block.

AGE

In children under eight years of age we use smaller doses of the drug. Between the ages of two and eight we inject one-half of the 4 c.c. of cerebrospinal fluid used to dissolve 0.1 gm. of drug. Below two years of age we use approximately one-third of the ampule. The youngest child in the series was two weeks old. We have recently used the double dose in a girl of seven for a craniectomy for depression of skull fragments following fracture. The anesthesia complete.

Aged patients are treated in the same way as young adults. The oldest patient subjected to this form of anesthesia was eighty-six years of age. The elderly patients seem to tolerate it better, if possible, than the younger ones. It is a common occurrence to have them ask as they are being taken back to the wards from the operating room when they are going to be operated upon.

TYPES OF OPERATIONS

The variety of procedures carried out under spinal anesthesia in this clinic is indicated by the following list:

1. Amputation of lower extremity up to hip.
2. Embolectomy of external iliac artery.
3. Herniotomy.
4. Reduction of fractures and dislocations.
5. Operation for osteomyelitis, lower and upper extremity.
6. Appendectomy.
7. Excision of rectum for carcinoma.
8. Colectomy.
9. Enterectomy.
10. Hemorrhoidectomy.
11. Anterior and posterior colporrhaphy.
12. Tracheloplasty.
13. Interposition operation.
14. Repair of vesicovaginal and recto-vaginal fistulae.
15. Salpingo-oophorectomy.
16. Hysterectomy.
17. Hysteropexy.
18. Nephropexy.
19. Nephrectomy.
20. Nephrolithotomy and pyelotomy.
21. Uretotomy.
22. Prostatectomy.
23. Cholecystectomy, choledochotomy, and cholecystenterostomy.
24. Splenectomy.
25. Gastrectomy, pylorectomy, pyloroplasty and gastroenterostomy.
26. Costatectomy and thorocotomy.
27. Radical mastectomy.
28. Embolectomy of the axillary artery.
29. Thyroidectomy.
30. Resection of cervical glands.
31. Excision of tumors of the tongue, face and scalp.
32. Crainectomy.
33. Mastoidectomy.
34. Nasal plastic.
35. Caesarian section.

Two of our associates, Drs. Edward L. Berger and Nathan D. Wolf have performed mastoidectomies under spinal anesthesia administered by this method. They commented favorably upon the patients' freedom from pain and made particular reference to the similarity to cadaver work because of anemia of the operative field.

In many instances, multiple operations were performed in the same patient. For example, many women have had a tracheloplasty, anterior and posterior colporrhaphy, sterilization, appendectomy and ventral uterine fixation performed at one sitting. Occasionally it was found necessary to add a cholecystectomy, through another inci-

sion of course, to treat thoroughly all the pathological conditions. In many instances it would not have been safe to do so many and varied operations on one individual under any other form of anesthesia. A not infrequent combination has been hysterectomy, cholecystectomy, appendectomy and perineorrhaphy.

PHYSIOLOGY

The anesthesia is apparently due to a block of the posterior roots of the spinal nerves which is similar to the block produced in the physiological laboratory by the action of chloroform, ether, etc., on the ischiadic nerve of the ischiadic-gastrocnemius preparation.

Testing the degree of sensation after injecting the anesthetic solution reveals a sudden and complete fall in conductivity. This can only be in the roots or in the cord itself because it is only there that the anesthetic solution comes into contact with nerve tissue. The property of conductivity is abolished very early, thus allowing operative trauma without sensation almost as quickly as the operative field can be sterilized and draped. The action of the anesthetic agent on nerve tissue depends upon an affinity between it and the lipoid substance in the nerve, a physiochemical solubility reaction occurring at the point of application. There is a relatively high saturation of the tissues with the anesthetic and a very rapid fixation by the lipoidal reaction. The union between the anesthetics of the cocaine group and nerve elements is a comparatively unstable one, unlike that of the quinine group. It results in rapid and complete interruption of conductivity particularly of sensory fibers.

The old ideas set forth in many works regarding the rate of diffusion of anesthetics introduced into the spinal canal, the factors which influenced diffusion and particularly the postural control of such diffusion are to our minds in need of considerable revision.

It must be remembered that fixation of the anesthetic solution by the nerve lipoids occurs rapidly and unless special factors are brought into play the amount of diffusion of 4 c.c. of the solution reinjected after withdrawal of that amount of cerebrospinal fluid will always be quite constant. The withdrawal of a greater amount of cerebrospinal fluid is an important modifying factor n determining the level of anesthesia. If the amount of fluid reinjected be kept constant, the greater the quantity withdrawn the greater will be the diffusion and, therefore, the higher the level of anesthesia. This is in accordance with the well-known physical law that the diffusion of liquids under pressure is inversely proportional to the pressure. The diminution of the cerebrospinal pressure caused by withdrawing a greater quantity of fluid causes greater diffusion of the reinjected fluid. It was recognized in a general way by those advocates of spinal anesthesia who advised against the withdrawal of cerebrospinal fluid, because of the possibility of the reinjected anesthetic solution reaching vital medullary centers.

This is in accord with the glass-tube experiment performed by Wells[1] in which he uses a glass tube of a length and caliber proportional to the average spinal canal with a piece of rubber tubing $\frac{1}{2}$ in. long attached to the lower end. The apparatus is held upright, is filled with water and both ends are sealed. A needle attached to a syringe filled with methylene blue is introduced into the lumen of the tube through the rubber. When the methylene blue is injected, it remains in the lower few inches of the tube. If one-half of the water is removed from the tube and then the coloring matter is reinjected, it is seen to pass to a much higher level. Again, if from the remaining half of the water, two-thirds are removed into the syringe and reinjected with methylene blue, the entire contents of the tube become colored.

Of course, reasoning by analogy is in itself very often·productive of errors. In this instance it must be remembered that the cerebrospinal system is not hydrostatic and therefore cannot be compared

with such a system without allowing for the difference. The hydrodynamics of the cerebrospinal system have not been studied sufficiently. The data at hand is insufficient. The variations in pressure along the system from the chorioid plexus to the point of absorption of the fluid are not known, nor are the factors which maintain and regulate the flow.

Increased diffusion, giving a higher level of anesthesia, may be produced by withdrawing a greater quantity of fluid, using it all as the solvent for the drug, and reinjecting it in toto. By this means we secure a diffusion up to the brain.

When the increased dose and the increased amount of solvent is used, and anesthesia of the head is obtained, cardiac and respiratory paralysis do not occur. At least one important factor in the prevention of that paralysis is the fact that the anesthetics of the cocaine group have a partial selective affinity for the sensory nerves. This selectivity of drugs for particular fibers is well known. In animal experimentation conduction anesthesia is best tested on the sciatic nerve by applying the anesthetic solution to a chosen segment of the nerve and testing for the disappearance of sensory conduction by stimulating peripherally and, conversely, for the disappearance of motor conduction by stimulating centrally.

According to Kochs,[2] the sensory conduction of the sciatic is lost after one minute, while the motor is not at first affected. Santesson[3] found that direct contact with 5 per cent solution of cocaine hydrochloride broke sensory conduction so completely that the strongest tetanic stimulation peripheral to the treated area was no longer able to produce a reflex, while the same concentration left the motor conduction unchanged for about one hour. Alms[4] found the threshold concentration for interrupting sensory conductivity attainable with much greater dilutions of anesthetic than for the motor interruption.

In studying the various types of nerve conduction in the vagus trunk above and below a cocainized area, Dixon[5] found that the centrifugal cardio-inhibitory vagus fibers lose their conductivity while the centripetal reflexly acting respiratory and circulatory fibers retain their conductivity.

There are other examples of the difference between sensory and motor elements. Sensory nerve endings are poisoned by cocaine but are not affected by curara. The motor endings are paralyzed by curara. Ammonia is a very strong stimulant to sensory endings in a wound, producing violent pain, but has scarcely any effect on motor nerves.

The selectivity of the cocaine group anesthetics for sensory fibers is only an extreme expansion of a general rule. The same differences are found in the reactions of the motor and sensory fibers to chloroform and ether. Hitzig[6] first demonstrated the disappearance of cerebral cortical sensibility long before the abolition of motor functions: "Even when every trace of reflexes has disappeared, and even the most intense sensory stimulation such as pulling on the dura and strong induced currents applied to mucous membranes of the nose, produced reflexes no longer, certain cortical motor areas still responded to stimuli."

Morphine even when given intravenously does not abolish cortical motor functions, whereas it has profound effect on the cortical sensory area.

Bernstein[7] demonstrated the parallelism between the spinal cord and the cerebrum as regards the effect of chloroform and ether on the motor and sensory fibers. He blocked the circulation to the lower part of the cord, and thus protected it from the chloroform circulating in the blood. The motor apparatus of the upper part, although exposed to the chloroform, still responded to impulses coming from the lower part of the cord, while the sensory mechanism of the poisoned section remained completely insensitive. It therefore appears that everywhere in the central nervous system the motor mechanism is particularly resistant to narcosis.

Thus, respiratory movements, initiated by purely automatic motor centers, may be maintained despite the existence of a

FIG. 6. The nerve of a nerve-muscle preparation is passed through a glass tube which is made air-tight by plugs of normal saline clay surrounding the nerve at the two ends of the tube. By means of two lateral tubulures narcotic vapor is passed through the tube. The nerve is alternately stimulated by two electrodes, the inner testing the action of the drug on excitability while the outer shows the effect on the conducting power of the nerve within the chamber.

stage of poisoning by anesthetics in which conduction in sensory fibers has long since been interrupted. It is this property of selectivity, dependent upon inherent differences in nerve-fiber endings and cells, which participate in the explanation of the phenomenon of surgical anesthesia of the entire body without respiratory or cardiac paralysis.

There is another factor which contributes to the possibility of such anesthesia. Nerve fiber possesses two separate and distinct properties; viz. excitability and conductivity. That these properties are separable has long been known. If part of the nerve of a frog gastrocnemius-ischiadicus preparation is enclosed in a chamber into which anesthetic vapor can be introduced and the nerve stimulated by two electrodes (Fig. 6), one within the chamber and the other peripheral to the chamber, and the muscular responses charted, a graph such as is shown in Figure 7 will be obtained. It is seen that the responses from the muscle on stimulation by the

chamber electrode begin to diminish in amount as soon as the vapor comes in contact with the nerve, and this diminution
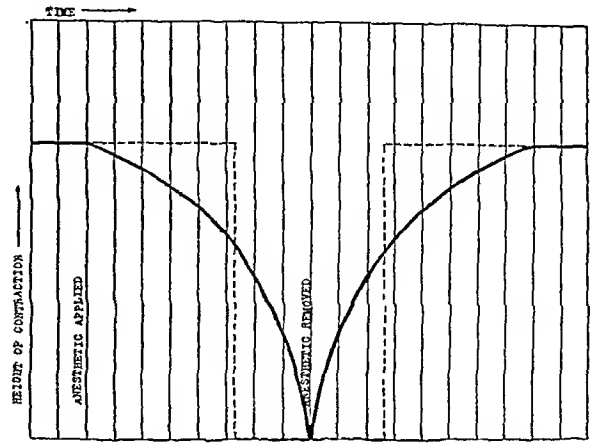
FIG. 7. Graph of outer electrode; response showing effect on conductivity. Graph of inner electrode; response showing effect on excitability.

increases by a definite decrement as the anesthetic continues its action. The peripheral electrode through which a stimulus of the same intensity is sent evokes a response which continues without decrement even though the anesthetic action proceeds. Ultimately, however, when the response to the stimulation by the chamber electrode has diminished considerably in amplitude, but is still present, there is a sudden and complete cessation of response to stimulation by the peripheral electrode. Continued application of the anesthetic results in a further gradual diminution in amplitude of response to stimulation by the chamber electrode until finally zero is reached. Removal of the anesthetic vapor from the chamber and continued stimulation at both points shows an immediate and gradual return in amplitude of response on stimulation by the chamber electrode and a much later, sudden and complete return of maximal response on stimulation by the peripheral electrode.

This can only be interpreted as meaning that with the vapor acting on the nerve within the chamber, there is a gradual loss of irritability of the contained part of the nerve, whereas the unaffected portion of the nerve remains normally excitable. As

the anesthetic continues its action and gradually diminishes the excitability of the contained portion, during which time the external portion of the nerve retains its excitability as is shown by maximal response, there is a sudden change in the nerve within the chamber which has the effect of preventing the impulse generated in the highly excitable nerve by the peripheral electrode, from passing down to the muscle. In other words the conductivity is interrupted. The interruption of conductivity always comes quite some time before the excitability is completely lost. Applying this to the action of anesthetic solutions on the medulla and upper cord it can be seen that it is possible to have anesthetic action to the point of interruption of sensory impulses in nerve fibers and yet be far from a complete depression of excitability of nerve cells. Thus, sensory impulses en route to the cerebrum may be stopped in the medulla because conductivity is interrupted, whereas the cardiac and respiratory nerve centers in the medulla, although their excitability is lowered, can still respond to the physico-chemical stimuli furnished by the blood by the initiation of motor impulses.

This factor and the selective affinity of the cocaine group anesthetics for sensory fibers explain the possibility of complete anesthesia of the entire body without respiratory or cardiac failure.

Manometric determinations of the cerebrospinal pressure were made in a large number of cases. It was found that the velocity of the flow from the needle lumen or the number of drops per minute was no indication at all of the height of pressure. Thus, with a flow of 20 drops to the minute it is possible to have a manometric pressure registration of 20 mm. mercury and conversely, when the spinal fluid emerges from the needle in a stream, the manometric pressure may not be above 10 mm. Velocity of flow must be sharply distinguished from pressure and must not be used as an indication of the latter if any degree of accuracy is desired.

In our cases we found a higher average cerebrospinal fluid pressure than the text-books describe. It ranges between 12 and 20 mm. mercury. These readings were all taken in the lateral prone posture, higher results being obtained when the registrations were made in the sitting position.

The older literature is mainly controversial on theoretical considerations of pressure measurements. What is very essential at this time is the accumulation of more data for the determination of normal limits of pressure. For example, why consider an individual who has suffered a head injury and in whom the manometer cerebrospinal pressure reading is 16 mm. mercury as having increased intracranial pressure for which treatment must be instituted when that pressure may well be within normal limits. More readings by many men and the reports of such observations will be very profitable.

In our first 500 cases operated under spinal anesthesia before the method was used for surgery above the diaphragm very careful blood-pressure records were kept and it was astonishing to note the variations encountered. It was found to be impossible to predict in any case, with any degree of accuracy, what would happen to the pressure after the injection. In some instances there would be no appreciable change. Other patients would show a maximum fall of 8 or 10 mm. mercury. A fairly large number would have a drop of between 20 and 30 mm. within ten minutes from the time of injection and this fall would be sustained for approximately three-quarters of an hour, the return to normal immediately preceding the return of sensation. Some would drop from 50 to 75 mm. within ten minutes after anesthesia administration and within another ten minutes would be back to within 20 mm. of the normal. In at least 5 per cent the pressure would drop within ten minutes to such a level that no radial pulse could be felt nor could the pressure be registered by manometer. At first this was very alarming, and all types of stimulation were resorted to.

Adrenaline intravenously, caffeine, strychnine, etc. were all tried; but it was finally concluded that with them or without them the pressure would return if the patient had been placed in the Trendelenburg position. In some of the cases where the pressure was not ascertainable because it was so low, the heart beat could readily be felt through the diaphragm. The collapse was a vascular one, not cardiac.

This is readily explainable. Every organ in the body requires an increased blood supply during activity. To accomplish this blood must be diverted from inactive to active tissues. This is brought about by a regulatory mechanism in the central nervous system. If the spinal cord be sectioned on a level with the origin of the first dorsal spinal nerve, the blood pressure sinks considerably even though there is a concommitant acceleration of the heart rate. The fall must, therefore, be due to a change affecting the blood vessels and lowering the resistance to the flow of blood. On making the section at the level of origin of the sixth dorsal nerve the fall is almost as great. Stimulation of the peripheral end of the cut cord causes a universal vasoconstriction and a corresponding rise in pressure. Section of the crura cerebri on the brain stem at the upper border of the fourth ventricle does not produce a fall in pressure. Destruction of a small portion of the medulla on either side of the mid-line in the neighborhood of the facial nucleus causes an immediate and maximal lowering of blood pressure. Stimulation of the anterior cervical or lower lumbar and sacral nerves has no influence on the blood pressure whereas stimulation of any anterior roots from the first dorsal to the third lumbar causes a rise of pressure. This same rise can be produced by stimulation of the white rami communicates from the anterior roots of the sympathetic system or by excitation of the sympathetic itself. This leads to the conclusion that all the vessels in the body are kept in a state of tonic contraction by impulses arising in a chief vasomotor center in the medulla and travelling down to the dorsal and upper lumbar regions of the cord from whence they leave to enter the sympathetic system by way of the white rami.

The great fall of pressure observed after section of the cord at the first dorsal segment is not permanent. After a few hours the pressure begins to rise and ultimately may reach a level almost as high as before the section. If the spinal cord of such an animal be destroyed, the pressure falls to zero and the circulation ceases because the animal "bleeds to death" into its own blood vessels. There must, therefore, be accessory vasomotor centers in the spinal cord probably in the gray matter of the lateral horns.

The nerve control of the blood vessels is maintained by two sets of fibers, one being motor or constrictor and the other inhibitor or dilator. The study of the origin and distribution of these fibers reveals that all the vasoconstrictor nerves of the body leave the spinal cord by the anterior roots of spinal nerves from the first dorsal to the third or fourth lumbar nerves inclusive, to go by way of the white rami communicantes to sympathetic ganglia. The most important vasomotor nerve is the splanchnic. It receives the major portion of fibers forming the white rami from the lower seven dorsal and upper two or three lumbar roots. The latter often take a separate course and are referred to as the lesser splanchnic. The greater splanchnic nerve supplies all the abdominal viscera and section of it causes a tremendous fall in the general blood pressure.

In spinal anesthesia (which is essentially a conduction root anesthesia) there is an interruption of impulses passing through the roots. Amongst other intercepted impulses are vasomotor stimuli coming from the medullary and spinal centers. The failure of the latter impulses to reach their destination results in a marked relaxation of the vessels whose tone they previously maintained. Since this anesthesia affects some, if not all, the lower dorsal roots, the splanchnic impulses are intercepted. The

complete loss of all their impulses can produce vascular relaxation in the abdominal vessels sufficient to hold all the blood in the body. This would cause a tremendous fall in blood pressure, so great perhaps that the brachial pressure could not be recorded. The brain, however, always demands a normal supply of blood and with such a marked splanchnic vasodilatation a sufficient supply to the brain can only be maintained by gravity drainage to the heart through the medium of the Trendelenburg position. Failure to utilize the Trendelenburg position results in fatal bulbar and cerebral anemia not due to cardiac paralysis but to an inability of the heart to receive enough return blood to send on to the brain. The condition might be compared to an internal hemorrhage, the bleeding being into the relaxed vessels of the abdominal cavity in which the venous pressure is nil and from which no blood is being returned to the heart.

With the Trendelenburg position it does not matter how great the fall in pressure may be. The vital nerve centers will not be inactivated. The literature on spinal anesthesia is replete with contraindications to its use, amongst which a generally cited one is hypotension. To us this is not tenable because it is firmly believed (on the basis of many experiences during operations where there was no recordable brachial artery pressure for a time) that with the patient in Trendelenburg posture there is no pressure too low to withstand operation. We have operated on patients for ruptured tubal pregnancies (in whom, despite treatment for shock and hemorrhage, the pressure did not rise above 55 mm. of mercury) with perfect equanimity as to the effect of the anesthetic and have not had reason to change our opinion.

When the higher level anesthesia was begun, it was feared that the blood pressure falls might be greater and more sustained. Apparently, it is not so. It must be remembered that separating the motor from the sensory roots is the liga-mentum denticulatum so that only near the site of puncture is the anterior diffusion great enough to affect thoroughly the anterior roots and their contained vasomotor fibers by sufficient saturation.

At present, and for some time past, we no longer record the blood pressure, feeling that the Trendelenburg position is the only necessary safeguard. Nor do we use vascular stimulants. It might be mentioned here that stimulants affecting the vasomotor centers would of course be of little value since impulses emanating from them could not pass the blockade. To increase the pressure it would be necessary to use drugs which act directly on the vessels. Cardiac stimulants are of little value unless fluid volume is also supplied to the heart.

APPLICABILITY

In many cases needing surgical treatment the choice of anesthesia is a matter of vast importance. The remarkable development of local, regional, paravertebral, splanchnic, etc. forms of anesthesia is a good indication of the failures of the inhalation method to fulfil the requirements of satisfactory anesthesia. These are safety, universal applicability, maximal relaxation, blandness in the sense that tissue irritation is not produced, ease of administration and freedom from shock.

It is believed that spinal anesthesia fulfils these requirements as no other method does. Quoting Bastron:[3] "It is not stretching the truth when I say that with faultless technique, . . . etc. . . . fatalities and bad effects should be fewer than with ether anesthesia." With the additions previously discussed the method is universally applicable. No other anesthesia can favorably compare with it in the production of muscular relaxation. While the relaxation encountered in abdominal operations is remarkable, perhaps a more striking demonstration is the effect on muscular spasm in fractures and dislocations. It is sufficient to see a 2 or 3 inch overriding of fragments of the femur in an adult easily reduced in two minutes

under the fluoroscope by the surgeon's pull of less than 50 lbs. tension to convince one of the profound effect in diminishing muscle tone. This diminution in tone is occasioned by the root block and is quite comparable to the laboratory experiment on the frog in which the entire central nervous system, excepting the spinal cord has been ablated, and then the nerves going to the left hind leg sectioned. The interruption of continuity of the reflex arc in such an animal by section of either anterior or posterior roots produces a complete loss of muscle tonus.

Excepting for the local trauma of the needle during the introduction there is no tissue irritation. The contrast with the effect of ether on the respiratory mucosa is very marked.

Any one who can do a lumbar puncture can induce spinal anesthesia; the method is reasonably "fool proof." There are very few movements necessary; no situation where individual judgment is necessary ever arises after administration; the only time when judgment is required is as to the dosage for various patients, e.g. for babies, children, adults. There are no contra-indications to its use except local infections at puncture site and cerebellar neoplasms.

Spinal anesthesia prevents operative shock. The blockade of shocking impulses coming from the operative field has a very beneficial influence on the central nervous system, and is at least as efficacious in producing the anoci-association of Crile as is local injection.

Special Indications. Thus, this form of anesthesia more nearly fulfils the requirements of the ideal anesthetic agent and method than any other. It is especially indicated in many conditions. Prominent amongst these is intestinal obstruction. Here, to combat the marked distention, the paralysis of the bowel in ileus of longer duration, to allow of gentle handling of tissue, to diminish shock of operative trauma, we have an ideal anesthetic. The abdominal wall becomes relaxed, the intestines do not project out of the incision, lap sponges are not needed to restrain the intestinal tract and thus peritoneal trauma is minimized. Furthermore the paralysis of the splanchnic inhibitory impulses allows a preponderance of vagus augmentor action which helps bring back intestinal tone.

Advanced cardiac disease is another definite indication for its use. Here, particularly with failing compensation, the greatest strain is upon the right side of the heart. The induction of anesthesia is accompanied by an effect comparable to phlebotomy, the drainage being into the abdominal veins. The fall in pressure rests the heart and its burden is considerably lightened throughout the duration of the anesthesia.

In advanced pulmonary diseases, complete freedom from pain without the dangerous irritation to the mucosa of the tracheobronchial tree, common to inhalation anesthetics, can easily be produced. In empyema thoracis necessitating costatectomy it is of considerable value. With local anesthesia a rib may be resected with facility but almost always when the cavity is opened to drain off the pus, no matter how slowly the latter is allowed to escape, there is a very distressing and sometimes dangerous dyspneic period. This is always avoided under spinal block.

In advanced renal disease it is highly essential to minimize anesthetic irritation of the kidneys. All inhalation anesthetics are more irritating than spinal. Intrathecal anesthesia is indicated especially in alcoholics since they require much greater amounts of inhalation anesthetic and usually have associated renal involvement. Such patients give far fewer premonitory symptoms of impending disaster with inhalation narcosis than the average case. For this reason, also, is spinal block of particular advantage.

Surgical patients with hypertension may be operated to advantage under spinal block. Ether and nitrous oxide both stimulate and raise the general blood pressure and are therefore not as well borne by hypertension cases.

In the aged, anemic or cachectic patient needing surgery the problem of anesthesia is ideally solved by spinal block. The inhalation anesthetics have a hemolysing effect on the blood and irritate the kidneys and broncho-pulmonary tree. The substitution of spinal-block for inhalation narcosis diminishes what would otherwise be .a greater operative tissue insult.

Spinal anesthesia is the most suitable anesthesia in operative procedures for the treatment of osteomyelitis. The shocking impulses attendent upon bone trauma by chisel and mallet are short circuited, and the deleterious effect of profuse hemorrhage is diminished by the relative anemia occasioned by the "splanchnic phlebotomy."

The abolition of the cough reflex by profound inhalation anesthesia is unquestionably a factor in the production of aspiration pulmonary complications. The elimination of such complications of anesthesia is accomplished by the root block surgery in metabolic diseases such as diabetes, nephrosis, exophthalmic goitre, and particularly those accompanied by acute toxemias as eclampsia and hyperemesis gravidarum should be done only under root-block to avoid many of the unpleasant features of the anesthetics already mentioned.

Inhalation anesthetics are best given to patients who have been properly prepared. Such anesthetics administered without adequate preparation in emergency surgery e.g. after a full meal, complicate operative procedure and may be productive of grave postoperative sequellae. Emergency surgery may be performed without these drawbacks under root block. This is particularly true in emergencies which are complicated by concomitant pulmonary infections.

These are some of the conditions in which spinal anesthesia is particularly valuable. The reader undoubtedly has begun to suspect by now that we believe not only in its universal applicability but also in its universal value. We realize that there are many surgical procedures in which it has not yet been tried and that perhaps contraindications to its use will be developed. We do not believe that the ordinary cited contraindications should be seriously regarded as such. The best example can perhaps be found in hypotension cases. Recognition of the "modus operandi" by which the blood-pressure fall is occasioned in spinal block and the use of Trendellenburg position for gravity drainage to the heart eliminates hypotension as a contraindication to the use of spinal anesthesia.

COMPLICATIONS

The most frequent complication encountered is postoperative headache. At first it was very troublesome. The application of the magnesium sulphate method for lowering cerebrospinal pressure used in head injury cases changed the aspect of this complication. It is easily controlled by retentive enemas of 6 oz. of a 50 per cent solution of magnesium sulphate every four hours. One case of intractable headache which did not respond completely to this method yielded to a spinal puncture through which 40 c.c. of fluid were removed from the canal.

We have had 2 cases of diplopia which cleared up in ten days, 1 case of paresthesia of the buttocks and anal region of three days' duration, and 1 case in which there was an inability to use the extensors of the left leg for about four months. The last case was one in which a tracheloplasty, perineorrhaphy, appendectomy, sterilization and hysteropexy were done. Eight days after operation the patient complained of inability to extend the leg forcibly and this condition became progressively worse so that at the end of two weeks, when she ordinarily would have been able to walk, she could stand only on her right lower extremity. There was considerable atrophy of the quadriceps extensor group, but the knee-jerk tendon reflex was not impaired. At the end of four months the condition cleared up entirely. The integrity of the reflex arc as shown by

the retained knee-jerk argues against root trauma by the needle. It seemed as though the lesion was trophic and may have been due to small filiform hemorrhages along the nerve roots described by Quincke.[9]

Not infrequently, if one is not conscious of the possibility, hematomas of the wound will be found on the day following the operation. This is due to failure to ligate vessels which bleed but slightly during the operation because of the lowered blood pressure. Later, after the wound is closed and the pressure rises, there is bleeding directly into the wound from the mouths of unligated vessels. It is therefore essential to be particularly careful with hemostasis.

Posterative urinary retention is not infrequently encountered. These cases may also be constipated. The knee jerks are exaggerated. Usually one or two catherizations suffice to clear up the condition. Rarely, there is persistence for four or five days and in these cases the picture reminds one of the animal with high lumbar section of the spinal cord.

Many of the postoperative complications such as headache, visual disturbances dizziness, etc. are due to increased cerebrospinal tension as a result of the original lumbar puncture. All of these phenomena have been recorded after simple lumbar tap. The greater the amount of fluid removed the more likelihood of symptoms developing. It is characteristic of the untoward after-effects that in the horizontal position they are usually either lessened or they disappear entirely while with every attempt to gain the sitting or erect posture they are aggravated. It is quite certain that the orifice made by the needle often fails to close for some time after its withdrawal, and allows a continual oozing through the puncture canal. The loss of fluid in this way in itself probably has no effect in the production of symptoms. They are probably the result of local irritation to the meninges. Even slight extravasations of blood may cause serous meningitis, which in turn results in increased fluid production and consequent symptoms.

CAUSES OF FAILURES

In the early days of our experience with spinal anesthesia we had 3 failures. Investi-
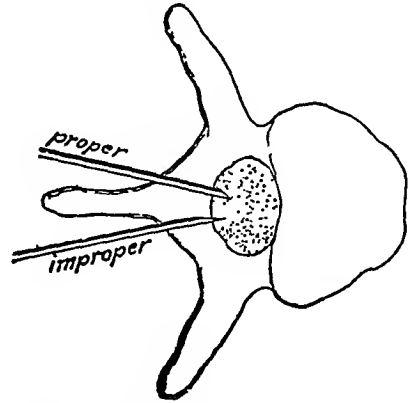
Fig. 8. Schematic representation showing how failure to secure anesthesia may occur. In the improper method the flow of cerebrospinal fluid through the needle misleads one into the belief that all the dissolved anesthetic will enter the subarachnoid space when it is injected. A great portion escapes through the proximal part of the bevel into the extra-arachnoid tissues.

gation disclosed a physical basis for the failures, and careful attention to details since then has eliminated such difficulty. The main cause of failure is either "dry tap," the avoidance of which has already been discussed, or injection of the anesthetic solution elsewhere than into the subarachnoid space. The latter may happen as a result of accidentally and unconsciously withdrawing the needle slightly while attaching the syringe for reinjection.

If a needle with a long bevel is used, only part of the bevelled edge may be within the subarachnoid space, allowing fluid to escape through the needle. When the reinjection is made, approximately half of the anesthetic solution may escape through the other portion of the bevelled edge into the extra-arachnoid tissues, so that the dose of anesthetic coming into contact with the nerve roots may be much less than expected, and insufficient to produce block (Fig. 8).

CONCLUSION

There is great danger of adopting procedures as fads in medical practice. This is of

course to be condemned. A method of inducing anesthesia must have more solid basis than faddishness to recommend it. We have attempted to set forth some of the more prominent reasons for the adoption of spinal block by the subarachnoid injection. More than usual space has been given to the physiological explanations of some of the phenomena because it is believed that a better understanding of the underlying principles will go a long way toward dissipating the unfounded fears of many surgeons who, though they recognize the limitations and drawbacks of inhalation narcosis, are still seeking for a more ideal anesthetic method. Beside the already enumerated advantages it should be remembered that this form of anesthesia can be administered and induced very rapidly, and by its use the surgeon is freed from the vagaries of different anesthetists. This emancipation in itself is a definite advantage. All other factors remaining constant, the fewer the links in the operative team, the fewer the chances of trouble arising.

Careful attention to the details of the technique will be rewarded by universal applicability, total freedom from pain, unparalled relaxation, a relative anemia giving a more bloodless operative field, quiet intestines needing no artificial restraint, interruption of the pathway of shocking impulses en route to the central nervous system and many advantages, all contributory to the ideal: maximum safety to the patient and simplification of the technical aspect of surgery.

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SPINAL ANESTHESIA

AN EXPERIENCE OF TWENTY-FOUR YEARS*

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PHILADELPHIA

SPINAL anesthesia offers to the operating surgeon the stimulus of a highly technical method directly under his own control. He assumes a personal responsibility for the success and safety of the analgesia. His injection determines the location, duration and degree of the anesthesia. If, during the operation, the patient has pain, or if the muscles are not well relaxed for the operation, the onus cannot be thrust upon an assistant; the blame rests upon the operator. With a successful anesthesia the surgeon finds the patient in ideal condition for the operation. There is complete freedom from pain or other sensation in the operative field; the tissues are absolutely relaxed, greatly facilitating operative manipulation; the intestines are contracted and do not protrude from the abdominal incision; and since the sphincters are relaxed and peristalsis augmented, the expulsion of flatus or other content of the lower bowel is strongly stimulated.

The effect of the few centigrams of drug used upon the parenchymatous cells of the body is inconspicuous. The brain, liver, kidneys, lungs are practically free from toxic action due to the anesthetic. In no other known way can so profound and extensive an anesthesia be produced by so small a dose of a drug and with so little general toxicity. With no other method does the depressing action of the anesthetic appear in the early stage of the operation when the patient can best withstand it.

The shock from the operation as it proceeds is, in part at least, antidoted by the rising blood pressure as the blocked sympathetic rami regain their function. When properly employed no other anesthetic of equal range leaves so few sequelae. Usually sensation returns without other symptoms. Ably used it is much quicker, simpler, less painful in induction, gives more uniform and dependable anesthesia and produces better relaxation than sacral anesthesia. If a well performed operation brings a sense of satisfaction, how much greater the achievement if it has been accomplished with comfort and relative safety to the patient and with the utmost facility to the operator. But spinal anesthesia has compensating disadvantages. It requires an accurate and precise technique for uniform results. A lack of skill in the administration is more obvious than with the use of ether; ignorance in using the method or lack of supervision during the period of analgesia may cost the patient his life. A death under chloroform or nitrous oxide often may be blamed upon the drug, but mortality with spinal anesthesia usually is to be blamed upon the surgeon. Spinal anesthesia therefore, necessitates a degree of skill and a working knowledge of the physiological actions involved. It is a very personal method, strongly appealing to the temperament of certain operators, but equally unadapted to others. It has supreme advantages for certain types of operation, but is to' be rigidly excluded from others. Perhaps with no other anesthetic are the indications or contra-indications more clearly evident.

In 1904, my attention was attracted to the advantages of spinal anesthesia by the work of Dr. Leon Kendirdjy in l'Hospital Cochin in Paris. A powerful synthetic local anesthetic, stovaine, had then recently been discovered among the amylene alcohols by the French chemist Fourneau while working in a laboratory

in Berlin. In his honor the drug had been given the English translation of his name, a stove. For use a 10 per cent solution of stovaine was dissolved in salt solution and sealed in ampules. Up to 7 c.c. of the solution was injected by a Quincke's puncture and the method was efficient for operations involving the leg, groin and genitals. Procuring a supply of the ampules, I immediately began the use of spinal anesthesia in Philadelphia.

My first difficulty was in introducing the needle. The available texts directed that the needle should be passed in a ventral and caudal direction, usually from a point lateral to the selected spinous interspace. Following these directions, in the lumbar region at least, the needle usually struck a lamina; but if introduced from the midline at about the center of a lumbar interspace and in a direction at right angles to the skin, an obstruction was and is rarely encountered. The second difficulty was in obtaining a sufficiently high zone of anesthesia. With the 10 per cent solution of stovaine injected through the third or fourth lumbar interspace, there was analgesia to about the level of the anterior superior iliac spines. This gave an anesthesia sufficient for operations upon the genitals and lower rectum, and usually for herniorrhaphy, but not high enough for an appendectomy or work in the upper abdomen. As cocaine and tropococaine solutions gave more extensive anesthesia the height at first was supposed to depend upon the drug used. It was soon found, however, that by reducing the percentage of the stovaine to 2 or to 4 per cent, thereby decreasing the specific gravity and increasing the bulk of the solution injected, and by eliminating the sodium chloride, an anesthesia to the level of the umbilicus was to be obtained. A preliminary decompression of the spine by the withdrawal of cerebrospinal fluid was also found to increase the height of the anesthesia and was advised in 1906.

By 1908, it was found that by still further lowering the specific gravity of the solution by the addition of 10 per cent of alcohol, a higher and more uniform anesthesia was possible; and it was also evident that a variation in the point of injection to correspond with the selected operative field was a distinct advantage. The addition of epinephrine, suggested by the experiments of Klopp was given considerable trial, but finally abandoned as disadvantageous. Solutions made heavy and viscid by the addition of gum acacia, glucose, mannitol, gelatine and other substances suggested by various observers were considered undesirable with the Trendelenburg position. Various drugs were tried including cocaine, alypin, eucaine, novocaine and tropococaine.

It was observed that all of these drugs were dangerous unless used with great care, and that none was more effective than stovaine. With the less toxic novocaine, which was used during a period of two years, about double the dose was required; the muscular relaxation was less complete, often interfering with the easy performance of an abdominal operation, and the patient frequently retained tactile, thermal, or pressure sense in the field of operation which at times he interpreted as painful. Usually with the stronger drug he was well relaxed and oblivious to the operative manipulations. The underlying physiological action gradually became apparent and it was evident we were dealing with a root block and not a medullary or cord anesthesia. It was found that the drug could be used upon new born infants as well as patients eighty-eight years of age. In fact, children tolerated spinal anesthesia very well, often slept during the operation and were more responsive than the aged, if resuscitative measures were required. The required dose was relatively larger in children and infants. An infant should receive $\frac{1}{4}$ to $\frac{1}{3}$ the dose of an adult; a 50 pound child one half the dose of a 200 pound adult. As the effect was purely a local blocking of the spinal nerve roots, the capacity of the spinal canal, rather than the weight

of the patient, indicated the size of the dose. Indeed, obesity and overweight brought increased risk, so that a smaller dose was used in such patients.

It was observed that a large dose could safely be used, if held in the lumbar region, while only very small doses could be used in the upper lumbar or cervical region. With a reduction in the size of the dose the duration of the anesthesia decreased in geometric ratio. An early impression that spinal anesthesia was desirable in shock, because it blocked the inflow of painful impressions to the centers, although supported by the experiments of Wainwright upon dogs, was modified by clinical experience. Spinal anesthesia might limit the development of shock during an operation, but it proved to be dangerous when used upon patients already in profound shock. The futility of centrally acting stimulants to improve the respiration or increase the blood pressure became evident. The ineffectiveness of strychnine introduced into the spinal canal, as suggested by Jonnesco in 1909, was shown. Doses sufficient to throw the portion of the body above the level of the anesthesia into convulsions could be given, and yet the strychnine could not drive impulses through nerve roots blocked by the intrathecal injection. Only after the spinal anesthesia disappeared, would the convulsions spread to the lower part of the body.

For the occasional respiratory depression encountered a useful indicator was found in the oscillations of a wisp of cotton affixed to the tip of the nose. With certain patients the usual methods of artificial respiration were found to be ineffective. The Meltzer Auer method of intratrachial insufflation did not prove well adapted for the emergency. Forced insufflation through an open tracheotomy wound, used in several instances, proved an effective but dangerous expedient. Finally, it was found that the simple method of mouth to mouth insufflation, while the nostrils and epigastrium were compressed, was uniformly effective in the cases in which compression of the chest failed to move the tidal air. A simple and quick method of cardiac massage by introducing the index finger through a stab wound through the third left intercostal space, proved to be effective in starting the arrested heart. But in my experience, permanent recoveries after cardiac massage have occurred only after the subdiaphragmatic method. The cerebrospinal fluid from about 150 patients presenting different conditions was studied and it was found that the specific gravity from childhood to old age and during a variety of different diseases maintained a remarkably constant specific gravity of about 1.0065.

In 1909, stimulated by Jonnesco's work, higher forms of spinal anesthesia were attempted. The small series included operations upon the thyroid, mastoid, cranium and mandible. To obtain a degree of safety it was found that the dose had to be so reduced that there was a great shortening of the length of the analgesia period. Despite the reduction in dose, serious respiratory embarrassment, from the blocking of the third, fourth and fifth cervical nerve roots supplying the diaphragm as well as the roots supplying the external muscles of respiration, was so frequent as to make the method unwarranted. Five methods by which the height of the analgesia could be raised were appreciated: *first*, by selecting a high interspace for the injection; *second*, by an increase in the bulk of the anesthetic solution injected; *third*, by decompressing the spinal canal accomplished by the withdrawal of cerebrospinal fluid before the injection was made; *fourth*, by gravity, the injected anesthetic fluid used being distinctly heavier or lighter than the cerebrospinal fluid. The location of the anesthesia is modified by the position in which the patient is placed during and after the injection, and *fifth*, forcible injection, especially with the needle inclined toward the head.

For the fall in blood pressure frequently

noted and for failure of heat action the injection of adrenaline intramuscularly, or were the emergency more acute, intravenously, proved to be the most effective measure.

By 1914, about six thousand injections had been made and 12 patients had died on the operating table while under spinal anesthesia. On reviewing the results, it was evident that the patients who had died under spinal anesthesia were for the most part patients who had hopeless conditions and would probably have died under any form of anesthesia. For example, one of these fatalities occurred during an operation for pulmonary abscess on a child with advanced, generalized miliary tuberculosis; one for advanced peritonitis from a perforated typhoid ulcer in a moribund man of sixty-four years; an operation on a pulseless man for avulsion of the arm at the shoulder under car wheels; an amputation for gangrene of the entire leg from a crush of the thigh of an elderly, alcoholic patient; and one for advanced, purulent peritonitis with extensive infection of the anterior abdominal wall from a gangrenous and strangulated hernia. It was decided in 1914 to therefore withhold spinal anesthesia from patients with conditions portending death on the operating table, to more carefully watch and supervise the patient under the spinal anesthesia and to be prepared for the prompt use of resuscitative measures should unfavorable symptoms develop. During the succeeding ten years, with about six thousand injections I had no death under spinal anesthesia, although during this time one patient died under nitrous oxide, one under ether and one patient in extremis died under local anesthesia by novocaine-adrenaline.

During the past four years, by the conjoint subcutaneous use of adrenaline, in a minor degree ephedrine and especially by the subcutaneous injection of 100 to 150 c.c. of a 1 per cent solution of procaine containing 9 to 15 mm. of adrenaline, we have extended the use of spinal anesthesia to many patients who were substandard risks. Two deaths have occurred under the anesthesia. One from an accidental massive injection of distilled water into a vein, the second from an advanced intestinal obstruction from cancer in an aged man. During the past fourteen years, 12 of the patients have had degrees of hypotension necessitating an intravenous injection of adrenaline, 3 required cardiac massage; 4 (1 from procaine, 1 from stovaine, 2 from butyne) had a predominant, respiratory paralysis; and probably were saved only by mouth to mouth insufflation; artificial respiration by compression of the chest being ineffective.

May a delayed spinal degeneration and paralysis follow the intradural injection? I doubt the existence of medullary paralysis from the proper use of spinal anesthesia. One of our patients had eleven inductions of spinal anesthesia without evidence of injury to the cord. In 1 patient, however, I produced a violent radiculitis by the injection of a nerve root.

With the use of a small spinal needle (No. 20 gauge or smaller) and of better anesthetic solutions, spinal headaches have become rare. Reber reported 5 cases of transient abducens palsy from my service in 1910. Evidently, it was due to a mild infection from the injection of contaminated solutions. It occurred after the use of imported ampules of stovaine and tropococaine and had an incubation period of seven days. It did not follow the use of alcoholized solutions, and it has not occurred in my service during the last eighteen years.

DIRECTIONS FOR SPINAL ANESTHESIA

1. For robust patients between thirty and sixty-five years of age a hypodermic of $\frac{1}{6}$ grain of morphine and of $\frac{1}{100}$ grain of hyoscine hydrobromide is given seventy-five minutes before the time of the operation.

2. For septic, shocked or asthenic patients the preliminary narcotism should not be employed. It is also to be avoided in children and the aged.

3. The back is prepared before the patient enters the operating room by washing, drying and painting with one-half strength of tincture of iodine.

4. Before the patient enters the operating room, the eyes are usually bandaged. Cotton may be packed into the ears.

5. The patient is made to sit upon the side of operating table well back from the edge with his elbows at his side and the forearms crossed in front of the abdomen. The head is then tilted forward until the chin touches the chest. The patient is held by the left arm of the assistant, which passes back of the patient's neck and in front of the patient's abdomen. The patient's back is now sponged with strong alcohol.

6. The spinal syringe with the piston separated and the needle containing the stilet are wrapped in gauze and are to be boiled in distilled water (no alkali) for ten minutes and brought to the operating room covered by a thin layer of *boiling water immediately* before the injection is given. The heat not only insures sterility but the warmth of the solution. If a fine sharp needle is used no local anesthetic is required for the skin.

7. The instant the needle is withdrawn from the patient's back, the patient is placed in position for operation upon the table and the table quickly tilted so as to lower the shoulders 2 in. below the level of the hips.

8. The patient's hands are to be so held throughout the operation that they cannot by any sudden movement invade the field of operation. A towel or sheet is so arranged that the patient's face is screened.

9. The pulse, respirations and color are to be as carefully observed as if ether were being given; the respirations by a wisp of cotton affixed to the tip of the nose. If the patient is awake, conversation to divert and encourage the patient should be carried on in a low tone. The patient is not to be informed as to the commencement of the operation nor should he be asked as to his sensation of pain. If possible, the thought of pain, fear or danger should not be suggested by the conversation of bystanders. If not contraindicated by the operation, the patient may be entertained by bits of cracked ice, little sips of water or even the privilege of smoking. If the patient is asthenic, has hypotension or myocardial weakness 100 to 150 c.c. of a 1 per cent procaine containing .7 to 1.0 c.c. of adrenaline solution are immediately injected about the field of operation.

10. Danger signs are marked fall in blood pressure, cyanosis, or respiratory depression. The premonitory sign is nausea or slight gagging. At this sign, the table is to be further tilted so as to lower the patient's head. If the patient is not a good subject, 10 mm. of adrenaline or 1 grain of ephedrine is to be immediately injected in the leg. A drop in the systolic blood pressure to 30 may require no stimulation in a young or vigorous patient while a fall to 50 in an asthenic, obese or aged patient arouses apprehension and is immediately to be counteracted. Loss of voice is an early sign of respiratory failure.

11. The danger period of spinal anesthesia is from five to twenty-five minutes after the injection. There is little danger in the average robust patient.

12. *After treatment.* The patient's shoulders should not be raised until one hour has elapsed from the time of the injection. Thereafter no special after treatment is necessary.

13. For asthenic patients a funnel and 6 in. of rubber tubing connected with a transfusion needle should be conveniently at hand with a flask of sterile physiological salt solution, a sterile dropper and a bottle of 1 to 1000 adrenaline solution.

14. Patients who have had narcotics are usually given a 1 to 2 quart enema of warm water after being returned to bed. If shocked or deeply stuporous one drachm of tincture of capsicum with 6 oz. of a strong decoction of coffee are incorporated in the enema.

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LUMBAR PUNCTURE TECHNIQUE*

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SPINAL puncture and tapping of the spinal fluid is a necessary preliminary to spinal anesthesia. If the puncture is improperly done, nerve structures may be injured, headache may be provoked, or difficulties may be encountered in the anesthesia itself. It therefore seems worth while to employ a well considered and careful technique.

The spinal needle should be of rustless material. Nickel-plated carbon steel needles may, without any external evidence of it, become so weakened by rust as to break within the tissues. This is a distressing complication. Needles of rustless material, such as rustless steel of the proper temper, or nickel, practically eliminate the possibility of this occurrence and at the same time require less care and attention.

The gauge should be as small as is practical. A small gauge needle makes a small hole in the dura and thus lessens the possibility of leakage and subsequent headache. It also breaks less easily than a large gauge needle, tending to bend instead. With very fine needles, however, the flow of spinal fluid becomes quite slow and mechanical difficulties are encountered with the stylet. Gauge No. 22 represents a fair compromise between these various considerations and has proved very satisfactory.

A length of 3 in. is enough for all but the most exceptional patient.

The point of the needle should be such as to inflict the least possible trauma on the patient and at the same time to deposit the anesthetic solution most surely within the dura. The long sharp bevel is now generally discarded. Greene,[1] from his experimental work, has concluded that a needle with a sharp cutting point produces a larger hole in the dura than a needle of the same size having a point rounded like a cambric needle. This is because the sharp edge cuts the longitudinal fibers of the dura while the cambric needlepoint tends simply to pry these fibers apart without cutting them, so that when the needle is withdrawn they may fall together again. His excellent clinical results in diagnostic lumbar puncture tend to confirm his conclusions from experimental evidence.

Because of these facts, we have used a needle with what might be called a conical point, one which is bevelled equally all the way round, and of which the stylet forms the apex. This needle has a sharp point for puncture of the dura, but this point becomes dull on withdrawal of the stylet. The opening at the end of the needle is then flat across the end and at right angles to the axis of the needle. As this opening is also quite small it is practically impossible, when fluid is obtained, to inject the anesthetic solution outside of the dura unless the needle is moved.

This type of point seems possibly to obstruct more easily than the ordinary bevelled point and when obstructed it is a little less easy to free. Its advantages, however, appear to outweigh these disadvantages.

Fine needles of the gauge suggested, on account of their flexibility, are less easy to use than are larger and stiffer needles. A stiff needle retains its direction even when traversing resistant tissues, and its direction may be altered while it is within the tissues. A fine needle, on the contrary, may bend on meeting resistance and its direction cannot be altered without practically complete withdrawal. Indeed, when using it one cannot be quite certain from the direction of the hub what the direction of the point is.

To meet these difficulties, we have devised an introducer, which is illustrated

herewith, and a description of which has recently been published.[2] In brief, it is essentially a cannula 1¼ in. long, with a
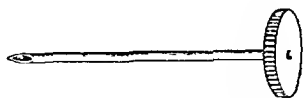
Fig. 1. The introducer, actual size.

sharp cutting point and a flange at the base, and of a size to accommodate readily the needle to be used. This introducer is employed by inserting it through the skin and posterior spinous ligament much like a thumb tack. After the spinal needle has been inserted through this, it acts as a brace or splint to prevent bending of the needle. The introducer itself pierces the more resistant tissues such as the skin and posterior spinous ligament, leaving less resistant tissues for the needle. Yet with the aid of the splinting effect of the introducer, the needle itself will pierce very resistant tissues without bending. We feel that this introducer eliminates difficulties of puncture due to the flexibility of fine gauge needles.

Local anesthesia preliminary to puncture is desirable because it saves the patient unnecessary pain and discomfort, and because he therefore keeps his position better during the puncture. The skin is the most sensitive structure concerned, the rest of the structures between it and the spinal canal having comparatively little sensation. The structures on the farther wall of the canal are sometimes the seat of slight pain if touched with the point of the needle. If a nerve trunk is touched sharp pain is caused at the distribution of the nerve. These last two sources of pain are largely eliminated by a careful and exact puncture. If, therefore, a wheal is raised in the skin of the back with procaine and a little of this is deposited in the posterior ligaments, a clean tap is practically painless. Thus the patient usually remains perfectly quiet in position during puncture. In contrast to this, where no local anesthe-

sia is used, the patient on feeling the needle enter the skin is apt to bow his back forward and get entirely out of position.

Lumbar puncture for spinal anesthesia is best made with the patient lying on the side. In the sitting position patients sometimes become faint and occasionally may vomit. Vomiting is still more apt to occur in this position if much preliminary narcosis has been used. A patient faint or vomiting will be apt to move and if he moves while the needle is in position, a tear of the dura with subsequent headache, will be very apt to result. Moreover, the sitting position is incorrect for some methods of inducing anesthesia. The back should be well bowed by an assistant by bringing the patient's knees up toward his chest and his head down toward his knees.

The interspace selected for puncture should present as few opportunities as possible for injury to important structures, should be as easy as possible for the puncture and should be at a point yielding as free and unobstructed a flow of fluid as possible. The end of the cord occasionally comes as low as the body of the second lumbar vertebra. To avoid the possibility of injury to the cord by the needle, the interspace chosen should be below the second lumbar vertebra. As anesthesia can easily be sent to any height, even from the lumbosacral interspace, it is unnecessary to choose a high interspace. As the arachnoid is sometimes adherent to the posterior aspect of the cord it is evident that if a high interspace is chosen the spinal needle may have to traverse the entire thickness of the cord before fluid can be obtained. The advantages of choosing a high interspace appear to be outweighed by the possibility of such an occurrence. At the lumbosacral interspace the nerve trunks are apt to be adherent to the arachnoid posteriorly. This leaves the second, third, and fourth lumbar interspaces as those where injury to nerve structures is least apt to occur. The fourth interspace is more apt to be obscured by overlying subcutaneous tissue than are the other two. For ordinary rou-

tine used in normal subjects the third lumbar interspace has proved satisfactory.

A serviceable way of making the actual puncture is as follows: After the local anesthesia has been injected, the interspace chosen is carefully palpated with the thumb of the left hand and the skin is steadied by pressing the thumb on the spinous process to the left of the interspace. If the skin is not steadied, it may easily slip to one side while the needle is piercing it and the needle thus be misdirected. With the skin thus steadied, the introducer is inserted in the center line about two-thirds way down the interspace through the skin and until its point engages the posterior spinous ligament. It is slanted very slightly up toward the head of the patient and the bevel is placed up. When the point has engaged in the spinous ligament, the adjacent spinous process is outlined by pressing the index finger and thumb of the left hand deeply in on each side of it and the position of the introducer is noted. It should be exactly in the center line. This is important for getting an accurate tap. With the introducer well centered, it is pushed slowly in, slanting it slightly, as before, and being especially careful to keep it at right angles to the lateral plane of the back. Rather firm resistance is usually felt as it traverses the posterior ligaments. It is stopped when about $\frac{1}{4}$ in. of the hub remains exposed, and the needle is then inserted through it. As the needle is started into the tissues beyond the introducer, pressure one way or the other should be made on the latter with the left hand so as to keep the needle always at right angles to the lateral plane of the back. The needle is pushed forward by placing the thumb of the right hand over the end of the hub and steadying the hand with the fingers on the back, so that, should resistance suddenly end, the needle will not jump forward. When the needle has been inserted far enough to establish firmly its direction, both hands may be used in the same way as an additional precaution. The needle is thus pushed slowly and carefully inward

until the dura is pierced. This is usually signalized by a distinct snap and a sudden lessening of resistance, but sometimes the snap is absent.

If, instead of piercing the dura, bone is encountered the needle should be withdrawn till its point is just within the introducer, the introducer should be put at a different angle in the median plane and the needle should be reinserted at the new angle, always being careful to keep it at right angles to the lateral plane of the back. If, after several trials at different angles, bone is still encountered the introducer should be withdrawn and reinserted in a different place, choosing first the middle of the interspace, then the lower and then the upper borders and, if all these fail, going to other interspaces.

If a nerve trunk is touched by the needle the patient will experience a sudden sharp pain at the distribution of the nerve. This denotes that the needle has deviated from the median line. The needle should therefore be withdrawn and re-inserted, keeping its direction a trifle farther away from the side on which the pain occurred.

After the needle has been correctly inserted and the dura has been pierced, the stylet is withdrawn and fluid should flow from the needle. If a clean tap has been made squarely in the median line, a free and unobstructed flow should result. This is very desirable, as fluid can then be drawn readily into the syringe and the induction of anesthesia is thus facilitated. Should fluid not flow because of low spinal fluid pressure, even though the needle is correctly placed, compression of the jugular veins will increase the pressure and cause fluid to flow.

Sometimes, though fluid flows from the needle on withdrawal of the stylet, yet when suction is made with the syringe the flow abruptly stops. If the technique of induction requires the withdrawal of fluid, such a tap makes the induction slower and more difficult. Sometimes slight withdrawal or further insertion of the needle will clear the flow. If a needle with the

ordinary one-sided bevel has been used, rotation will help.

Sometimes the flow from the needle is tinged with blood. This usually means that the point of the needle has punctured a vein on the farther side of the canal. In this case slight withdrawal of the needle will cause the fluid to clear, when the induction may be safely proceeded with. Pitkin has shown[3] that the vein pressure is usually below that of the spinal fluid so that the chance of any material amount of bleeding taking place is quite remote.

In conclusion, a careful and painstaking technique of lumbar puncture seems well worth while because it protects the patient as far as possible from cord injury, from nerve injury, from tears in the dura, from multiple punctures of the dura, and from vein hemorrhage, and because a good puncture is the first essential of a good anesthesia, rendering subsequent steps more easy and certain.

A technique is here presented which has proved satisfactory. There have been no cord or nerve injuries. There have been one per cent of headaches of more than slight severity, chiefly in patients who moved during puncture. There have been one per cent of failures to make puncture, each case being in a patient with rigid spine. There have been no failures to produce anesthesia after puncture.

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POSSIBLE COMPLICATIONS WITH
SPINAL ANESTHESIA
THEIR RECOGNITION AND THE MEASURES EMPLOYED TO PREVENT AND TO COMBAT THEM *

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THE complications and after-effects of spinal anesthesia are less understood and consequently more feared by the surgeon than many of the complications of general anesthesia or of major operations. After a thorough study of this type of anesthesia one is forced to the conclusion that the usual complications can be explained on a physiological basis. In most cases, moreover, they can be foreseen and prevented.

By always employing the same drug, of known purity, an aseptic technique and atraumatic surgery, it is possible to limit the after-symptoms to those which result from a fall in blood pressure. Respiratory failure was formerly the most serious complication. It is seldom, if ever, seen with the newer drugs and more modern methods of induction. The literature shows that it has been a rare complication and is associated with errors in technique and with overdosage.

In this chapter the complications will be discussed with their characteristic signs and symptoms. Each complication must be thoroughly understood so that it may be quickly recognized and combated.

These complications are not due per se to a general toxemia from absorption of the drug as the dose employed is altogether too small to produce such a condition. They are the result of the direct or selective action of the drug on those vital centers that are bathed in the spinal fluid, of a fault in technique, or of mistakes in the preoperative and postoperative care of the patient.

Classification. They are divided into the immediate, the intermediate and the late complications. The immediate symptoms are: (1) those of shock or syncope, which occur at the time of the lumbar puncture or when the drug is first injected; (2) the nausea or cold sweats occurring at the same time; (3) those resulting from depressed function following visceral sympathetic paralysis. The intermediate symptoms are those of headache, backache, stiff neck and the other symptoms of meningeal irritation. The late symptoms are palsies, persistent headaches and neuroses, all of which are possibly due to faults of technique. The immediate symptoms are due to the toxic action of the drug on the nerves and nerve centers or to the shock which very rarely accompanies the lumbar tap. The intermediate and late symptoms are the irritative results of the spinal injection or the results of spinal fluid leakage.

A. VASOMOTOR PARALYSIS

The fall in blood pressure with its resulting acute bulbar anemia is the most important and the most dreaded of all the complications of spinal anesthesia. The work of Babcock and others has made it possible for one to carry a patient through a vasomotor collapse with the assurance that within a few minutes the effects of the drug will wear off and the sympathetic fibers will regain their normal control.

This sudden fall in blood pressure is followed by nausea, which if not relieved will lead to vomiting, pallor of the skin, a feeling of compression about the chest,

* A chapter from the author's forthcoming book on "Spinal Anesthesia."

581

thirst, air hunger, cold sweats, and a slowing of the pulse and respirations. With a complete collapse in which the whole

all it occurs during the first fifteen minutes after the injection or when the patient is suddenly moved. The degree of paralysis
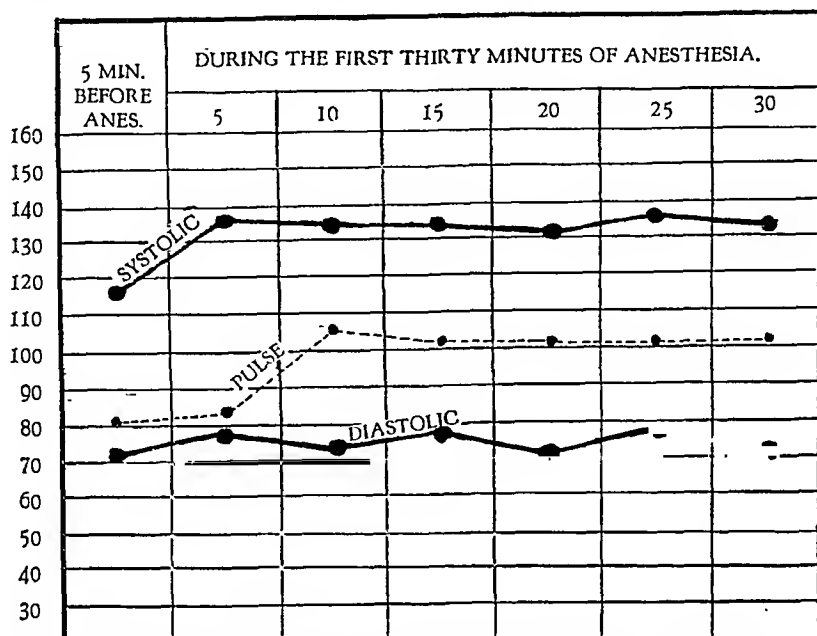
Fig. 1. Blood pressure and pulse during first thirty minutes after low spinal anesthesia for amputation of leg.

Patient weighed 145 lbs. Given 8 cg. neocaine, injected in fourth lumbar interspace. Morphine sulphate, grain ⅙, given one and a half hours before and morphine sulphate, grain ⅙, three-quarters of an hour before operation. Adrenaline solution ¹⁄₁₀₀₀, minims 10, injected deep into gluteal muscles just before spinal injection. No nausea or vomiting. Patient comfortable and calm throughout operation. Note that there was no drop in blood pressure or pulse. Similar results should be procured in any operation on lower extremities or perineum. When injection is made in fourth or fifth lumbar interspace and head and shoulders kept elevated, there should be no great diffusion of drug upward and therefore no involvement of basomotor fibers. In fact no sympathetic stimulant is needed in these cases.

splanchnic nervous system is blocked and the blood has collected in the great splanchnic pool, the blood pressure may fall to zero. The function of the liver, kidneys and the other organs may be greatly diminished. The patient may become unconscious with cessation of the heart beat. In such cases, if respirations are maintained and the heart is not allowed to stop, a fall of blood pressure to zero at the wrist is well born and the patient none the worse because of it. With the proper treatment the blood pressure can be gradually restored, the vital organs returned to normal function, and consciousness can be regained. There remains little if any damage because of this transient paralysis.

If vasomotor paralysis is to occur at

is governed by the depressed condition of the patient and the height and strength of the anesthesia. During the first fifteen minutes the maximum anesthesia is reached, after which there is a readjustment and the body functions gradually approach the normal. The reactions of the patient during the first few minutes of a normal spinal anesthesia are in many respects opposite to those of the patient during the first few minutes of a general anesthesia. In the latter there is excitement, muscular exertion, increased breathing, fast heart rate and a bounding pulse, while the patient is becoming more depressed. In the former there is normal breathing a warm dry skin and improvement of the general condition as the operation advances (Figs. 1–3).

Prevention and Treatment

Adrenaline, a peripheral vasomotor constrictor, is the only drug that satisfactorily

Fig. 2. Blood pressure and pulse during first thirty minutes of moderately high spinal anesthesia for radical repair of large inguinal (scrotal) hernia.

Patient forty-one years old, weight about 130 lbs. Spinal needle inserted in third lumbar interspace and 10 cgms. neocaine given in usual manner. Morphine sulphate, grain 1/6, with atropine sulphate, grain 1/150, given three-quarters of an hour before operation. Adrenaline solution 1/1000, minims 15, injected deep into gluteal muscles just before spinal puncture. Head and shoulders elevated throughout. No nausea or vomiting. Towards end of operation it was necessary to make traction on hernial sac. Patient became very nervous and was given light nitrous oxide anesthesia.

counteracts the central vasodilation produced by spinal anesthesia. When injected deep into the gluteal muscles it causes an increase in blood pressure which will usually last from twenty-five to thirty minutes. In the average case this covers adequately the time during which a high anesthesia would cause a drop in blood pressure. The low blood pressure occurring with spinal anesthesia usually lasts from twenty-five to thirty minutes. After this time the action of the drug has worn off sufficiently to allow the blood pressure to return to about normal. When the blood pressure becomes extremely low the adrenaline infusion is used. It is prepared before anesthesia is started and contains 1 minim of 1:1000 adrenaline to each 100 c.c. of physiologic salt solution. If properly given it will raise the blood pressure and keep

it raised until the normal vasomotor tone is reestablished. As adrenalin is a very powerful vasomotor and cardiac stimulant it should be given intravenously only in this great dilution. The infusion should proceed very slowly and should be discontinued as soon as the desired effects have been obtained. One thousand cubic centimeters may be given without fear of overstimulating the patient.

The whole syndrome is that of cerebral anemia excepting the slowing of the heart which is due to the unrestricted action of the vagus nerve. That the slowing of the respirations and the depressed feeling in the chest is not due to respiratory failure or paralysis is shown by the patient's relief when the head is lowered, forced breathing started or a cardiac stimulant administered. To prevent or to overcome any dangerous fall of blood pressure one should closely follow a well-outlined routine. The following has proved quite satisfactory:

(a) Carefully train the patient in the correct form of deep breathing. This should be done before the operation.

(f) After the spinal injection place the patient on his back, elevating the head and shoulders. Place wet towels on the
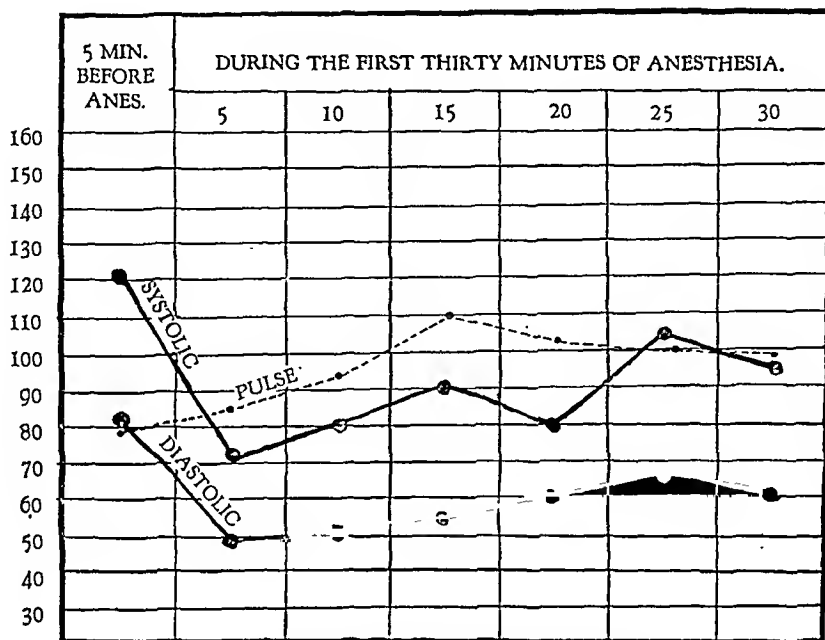
FIG. 3. Blood pressure and pulse during first thirty minutes of high spinal anesthesia for choledochotomy, cholecystectomy and appendectomy.

Patient an Itailan woman, fifty-eight years old, weight 115 lbs. Given 8 cg. neocaine in first lumbar interspace (patient sitting) and 5 c.c. of spinal fluid withdrawn for last dilution. Morphine sulphate, grain ⅛, given one and a half hours before and morphine sulphate, grain ⅙, with scopolamine sulphate, grain 1/300, given three-quarters of an hour before operation. Adrenaline solution 1/1000, minims 12, injected deep in gluteal muscles just before spinal injection. Head and shoulders elevated throughout. Patient not nauseated and did not vomit. Was comfortable during operation, except at one time complained of pulling pain when traction was made on common duct (see drop in blood pressure followed by rise). Blood pressure normal one and one-half hours after operation and patient showed very little reaction following the operation. No signs of shock at any time.

(b) Read the blood pressure frequently, especially during the first part of the operation.

(c) Use sufficient preoperative morphine and atropine. To an ordinary sized man in good health morphine, gram ¼ and atropine, gram 1/150, is usually given. The morphine quiets the patient and the atropine tends to overcome the depressing effect of the anesthetic drug on the cardiac rate.

(d) Two or three minutes before the neocaine is injected, give the calculated dose of adrenaline. Be sure that it is given deeply into the gluteal muscles.

(e) Carefully calculate the dose of neocaine for both the weight of the patient and the time necessary for the operation.

face and, if there is any thirst, give cracked ice.

(g) See that the oxygen inhalation is constantly given. Start it at the very beginning and continue it until after the operation is finished.

(h) With the first sign of nausea or abdominal distress, remove the oxygen tube, compress both nostrils and force the patient to take twelve to fifteen deep breaths, breathing through the mouth. This will usually clear up the condition, after which oxygen inhalation can be recommended.

(i) If nausea continues and the patient vomits or if the blood pressure continues to drop, remove the pillows from under the head and place the patient in the

Trendelenburg position. This is the first treatment for bulbar anemia, but should not be done until definite symptoms have appeared.

(j) If the blood pressure goes below 40 mm. of mercury or the pulse becomes imperceptible or the respirations very shallow more radical treatment is indicated. Start the intravenous infusion of physiologic salt solution containing the adrenaline. Give the fluid slowly and discontinue when there is a good radial pulse, but leave the apparatus connected so that more of the fluid may be given if indicated.

(k) If the pulse remains imperceptible or there is danger of cardiac or respiratory failure, a still more radical treatment is indicated. Begin artificial respiration. This should be started, of course, before the heart has stopped beating. It is almost impossible, using the modern methods, to completely depress cardiac function. The operator should be familiar with the art of giving intraventricular adrenaline and cardiac massage should complete depression occur.

The foregoing discussion on vasomotor paralysis illustrates what may happen, especially when an overdose of the drug is given or when the normal dose is given to the adynamic patient who is not carefully watched. If he is watchful and uses correct technique he will rarely if ever have to use the more radical procedures outlined. Many surgeons have used spinal anesthesia without even the milder symptoms of a vasomotor collapse. Very few, even in the larger clinics, have seen a spinal anesthesia death following a well-conducted method used on a properly selected case. Yet many of us have seen deaths due to ether or chloroform anesthesia.

During the early part of 1928 Dr. Walter D. Ludlum, Jr. and the author carefully followed over 200 cases which were operated upon under spinal anesthesia at the New York Post-Graduate Hospital. We found that with the use of the technique outlined in this monograph we could induce anesthesia and at the same time maintain a sustained blood pressure and pulse rate. In every case the calculated dose of adrenaline was given deep in the gluteal muscles. The amount of neocaine given was calculated for the condition of the patient, the site demanding surgery and the time needed for the operation. The patient's head and shoulders were elevated on two or more pillows. The blood pressure and pulse were carefully checked and an endeavor was made to keep the patient's mind occupied and interested in some pleasing subject.

When time and condition permitted we recorded the blood pressure and pulse every five minutes, beginning five minutes before the injection and continuing for forty minutes. Some of the operations did not take thirty-five minutes, in which case the observations were stopped at the end of the operation. It was noted that while there was usually a slight drop in blood pressure with the high anesthesias, there was a rise in the blood pressure for the mid and low anesthesias used for herniae, vaginal plastic operations, rectal operations, amputations and other surgical conditions of the lower extremities.

In the 200 cases observed there was in no instance a dangerous drop in blood pressure and at no time after the injection was there any indication for infusions or other stimulative methods. Of this number 17 whose blood pressures and pulse rates were recorded are taken as a guide to illustrate the maintenance of the blood pressure and the pulse rate. The blood pressure rose in 12 cases, i.e. 75 per cent. The lowest reading was 44 mm. Hg and the next lowest was 62 mm. The pulse rate rose in 7 cases, i.e. 43.8 per cent, the lowest pulse reading being 44 and the next lowest 66.

The 17 cases included 4 high anesthesias for gall-bladder and stomach surgery, 5 mid-anesthesias (up to the navel) for low abdominal surgery including herniae, and 8 low anesthesias for perineal, rectal and lower extremity work.

Results are shown in Figure 4. The average of the readings for the five-minute periods has been taken and charted

properties to the depressant action of the novocaine products.

(3) Lowering the patient's head and
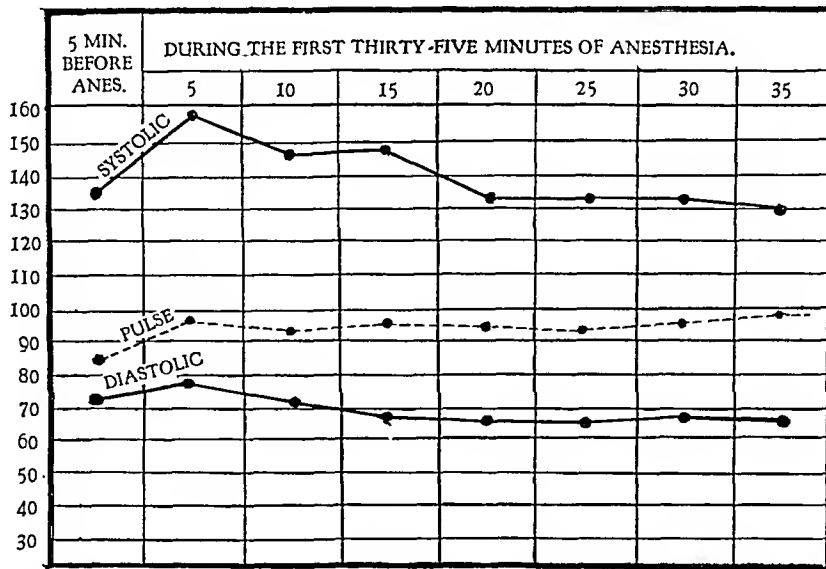
FIG. 4. Graph showing how blood pressure and pulse rate can be sustained with spinal anesthesia. Curves represent average of each of five-minute readings. There were 17 cases in series, including 4 high, 5 medium, and 8 low anesthesias.

to show graphically the systolic and the diastolic blood pressures and the pulse rate for each five-minute period.

From the results shown in the graph and from our observations of other patients whose pulse and blood pressure were not followed in such detail we feel justified in making this preliminary report and believe the following conclusions to be justified:

(1) With the method outlined in this monograph it is possible to give a spinal anesthesia with assurance that there will be either a rise in blood pressure or a slight drop which should not be considered dangerous. We do not fear a drop but rather expect a rise in blood pressure when the operation is in the inguinal, perineal, rectal or lower extremity region. In the upper abdomen we expect some drop in the blood pressure, but slight and without danger.

(2) Adrenaline when injected deep intramuscularly and associated with tactful care of the patient, proper preliminary medication and the low injection of neocaine has apparently definite antagonistic

shoulders tends to cause the anesthetic solution to ascend in the cephalad direction in the dural canal. By keeping the patient's head and shoulders raised it is possible to retard the upward diffusion of the anesthetizing drug and in addition to keeping the drug from reaching the upper vasomotor fibers, allow the patient the most comfortable and physiologically the most correct position.

(4) After carefully considering the physiology of the drop in blood pressure and the slowing of the heart rate we are confident that a close check on the pulse rate and volume is an adequate means of following the general condition of the patient and the height of the anesthesia. When the drug reaches the upper vasomotor fibers causing general vasodilatation it will at the same time depress the sympathetic fibers to the heart and, by allowing the vagus to become overactive, slow the heart rate.

Throughout this series of cases we found that the routine administration of oxygen was not necessary but could be used with

benefit in a limited number of cases. We did not use it routinely except in the high anesthesias. We also found that for the low anesthesias it was possible to keep the anesthetic so low that there would not be any vasomotor fibers involved, therefore eliminating the necessity for the intramuscular injection of adrenaline. The author advises the use of adrenaline in every case. The use of oxygen should be adopted by all inexperienced workers administering spinal anesthesia, especially for all operative procedures above the perineum. Oxygen inhalation is an additional safeguard. It is at all times unsafe to give a spinal anesthesia without a gas oxygen machine or ether for use in the event that there is an incomplete anesthesia or an unforeseen prolongation of the operation.

B. RESPIRATORY PARALYSIS

In spinal anesthesia a slight respiratory depression may occur without any degree of respiratory paralysis. This is not true respiratory paralysis due to the drug but is the result of lessened bulbar function due to anemia plus cessation of abdominal breathing. This shallow breathing with frequent intervals of deep sighs readily clears up as the pallor, insomnia and other symptoms of a lowered blood pressure are relieved.

When the patient's respirations slow gradually the cause is paralysis of the phrenic nerve and not of the respiratory center. With neocaine or similar novocaine products, fortunately, it is almost impossible to paralyze the upper cervical nerves when the drug is injected below the twelfth dorsal vertebra. This is because these nerves, which are very resistant to the action of the drug, are bathed in an extremely dilute anesthetic solution. The author has seen the dura punctured twice during a caudal anesthesia. In each case 35 c.c. of a 2 per cent neocaine solution (70 cgms. of neocaine, about six times the maximum dose) were supposedly injected intradurally. There was sensory anesthesia

to the lower lip in one, to the chin in the other, with no alarming symptoms only, a slight slowing of the pulse and respirations being noted.

True respiratory failure is due to a high anesthesia and it will vary with the height and concentration of the anesthetic, the vitality of the patient and the vigilance of the operator. When the roots of the cervical nerves leading to the diaphragm are involved, true respiratory failure begins; the unaided diaphragmatic breathing may cease so that the tidal air cannot be moved. This condition may be overlooked until far advanced. The patient may still be able to move the lips and tongue but be unable to talk. Cyanosis and unconsciousness may develop and the heart stop beating unless artificial respiration is begun. This is the important complication of high anesthesias and may prove fatal unless the operator understands what is happening and is prepared to combat it. If he is careful and vigilant, respiratory failure need not be feared. In event that it does occur through some error in technique proceed as follows:

(a) Stop all operative procedures and work to save the patient.

(b) Treat the vasomotor collapse which accompanies respiratory failure. It is an early sign and if treated early the more serious sequelae will be avoided.

(c) If respiration should cease, keep cool. Raise the lower jaw, pull the tongue forward and begin artificial respiration at a uniform rate. Mouth to mouth insufflation is the most convenient and efficacious method of artificial respiration. A wisp of cotton placed on the tip of the patient's nose and held there with collodion will register the frequency and depth of respiration.

(d) Do not give up until all methods have been exhausted and until after the heart beat and the respirations have ceased for more than thirty minutes.

Sudden respiratory failure, the most dangerous complication of spinal anesthesia, is due to the lumbar puncture and

is described under "Shock and Syncope." The author has also described under that heading a complication which has never occurred in his personal experience but which may happen if faulty technique is used or if the patients are unwisely chosen. Certain individuals, particularly those of the status lymphaticus type, are subject to sudden and complete collapse, even death, when any unusual surgical procedure is performed on them. Such accidents to these patients have been frequently reported following tonsillectomy or even a general anesthesia alone. Cases have also been reported following a routine lumbar puncture or thoracentesis. Individuals in this group are bad risks for any surgical procedure and, unfortunately, cannot always, with our present knowledge, be detected before operation.

It is necessary to have a well-trained individual to check the pulse, blood pressure and general condition of the patient at frequent intervals during the course of the anesthesia. At one time a surgeon noticed that the patient was in poor condition and asked the nurse what the nature of the pulse was. The reply was startling! "Sir! I have not been able to get the pulse for several minutes." The patient was almost pulseless but an intravenous infusion was begun at once and fortunately the patient was soon in good condition once more. Such occurrences are, of course, inexcusable.

C. SHOCK AND SYNCOPE

The majority of the deaths which have been attributed to spinal anesthesia have been the result of shock. No doubt many of these fatalities were the result of improper technique or disregard of definite contraindications. There are at least six ways in which shock or syncope may be produced during spinal anesthesia:

Prevention and Care

1. *Lumbar Puncture or Meningeal Reflex.* This may occur in the nervous or over-stimulated patient, especially where insufficient preoperative morphine has been given. It may follow an injury to the meninges when a large needle is used or repeated attempts have been made to enter the dural canal, or when the patient has been kept too long in the sitting position. The onset in these cases is usually sudden complete collapse with cessation of the function of the vital centers. The result is variable, from a mild fainting spell to sudden death. A few such deaths have been reported but can probably be explained on the basis of the status lymphaticus type, as mentioned above.

2. *Visceral Reflex Shock.* This may occur when the intestines are too roughly handled, when the stomach or omentum is pulled upon, or when the upper abdominal organs are tightly packed off. It is the result of disregarding the principles of atraumatic surgery and should not occur with those who are zealous of their technique. This complication is further discussed under "Nausea and Vomiting."

3. *Hypersusceptibility.* Very rarely there is an individual who is hypersusceptible to neocaine. Therefore an acute drug poisoning may occur following its intraspinal administration. One should be able to recognize and treat such a condition. The drug poisoning may be due to such hypersusceptibility, or to an unusually strong drug, or to the accidental injection of the drug into one of the meningeal veins. The symptoms are those of anaphylactic shock and the treatment is, as outlined elsewhere, that for vasomotor collapse and respiratory failure.

4. *Position Shock.* This form of shock occurs when the patient is suddenly changed from one position to another, especially from the Trendelenburg to the horizontal position. It occurs most frequently in weak or very old patients. These patients have had what, for them, is an almost lethal dose of the drug and have had low blood pressure and a decreased respiratory rate throughout the operation. It results from a sudden added embarrassment to an already overladen heart. It is the most common complication

occurring at the end of the operation. Patients who have been quiet and apparently asleep during the operation seem most often affected in this way. It should always be remembered, therefore, that the patient who is too quiet, especially if aged and possessing lowered vitality, should be watched more closely for symptoms of shock and should not be subjected to any sudden change in position or other added embarrassment to his circulatory system.

When this condition occurs it is usually moderately mild, accompanied by sudden nausea, pallor and possibly vomiting, all of which quickly disappear with the following treatment:

(a) Place the patient in the Trendelenburg position.

(b) Force the usual exaggerated breathing.

(c) Give 10 minims of adrenalin intramuscularly. This usually clears up the symptoms so that the patient can be moved without further danger.

(d) If, however, the pallor and general depression continue, an infusion containing adrenalin should be started.

(e) If there are signs of either cardiac or respiratory failure, pull up the lower jaw and be ready to begin artificial respiration at once.

5. *Intracranial Pressure Shock.* This may lead to the death which is known as the "lumbar puncture death." It may have been the cause of many deaths which have been cited to prove spinal anesthesia a radical and unsafe anesthesia. It is the commonest cause of death following the simple lumbar puncture, yet diagnostic lumbar puncture continues to be a standard and valuable procedure. Schönbeck thoroughly reviewed the literature and has collected 71 cases. Over 50 per cent had intracranial tumors; 13 per cent had cerebral hemorrhage; 57 or 58 per cent of the cases presented symptoms of some cerebrospinal pathology which was present at the time of the lumbar puncture.

This acute condition results from a loss of the spinal fluid, either at the time of the puncture or by later leakage through the dural opening. Due to the release of spinal fluid pressure below, the medulla is jammed into the surrounding foramen magnum. Death may be sudden, beginning with a terrific headache, or it may occur within a few hours. It is due to suppression of the medullary centers and the symptoms are those characteristic of severe intracranial pressure. This condition si extremely rare and need not be feared if the following simple rules are observed:

(a) Take a careful history and make a complete physical examination. Then strictly adhere to the definite contraindications for this anesthesia.

(b) Keep the patient on his side during the lumbar puncture and the injection. Do not allow him to sit up for at least twenty-four hours after the injection.

(c) Use a small spinal needle, held so that it will split and not rupture the dural fibers. This will minimize the spinal fluid leakage.

D. MENINGITIS

Meningitis is a complication which occurs in a frequency which is proportional to the faults in technique. With those using correct technique it is so rare as to be practically non-existent.

Prevention and Treatment

1. *Non-infective Irritative Meningitis.* This is an irritative condition of the meninges which is often spoken of as "meningismus." It is essentially a congestion with resulting exudation following the exposure of the meninges to any toxic substance. It may follow a toxic dose of the drug, capillary hemorrhage when a dural blood vessel is punctured, trauma to the dura when several attempts are necessary to enter the dural cavity, the injection of air bubbles into the dural cavity or the introduction of foreign material such as rust or dirt which may come from the syringe, needle or drug.

Beginning twelve to twenty-four hours after the injection the patient shows mild meningeal symptoms such as pain along

the spine, stiff neck, photophobia and nervousness. There may be rarely a persistent headache, while the more severe cases may show some involvement of the eye muscles. There is an increase in the spinal fluid pressure and an examination of this fluid shows an increased cell count but no marked increase in globulin.

The condition is very rare. The symptoms are mild and disappear after six to ten days with no after effects, except possibly a later neurosis which should be prevented. The following measures should be employed as indicated:

(a) The back pain is often relieved by placing a pillow under the small of the back.

(b) The persistent headache will be relieved by the withdrawal of 10 to 15 c.c. of the spinal fluid.

(c) The nervousness and later neuroses can be overcome by reassuring the patient. Never discuss the complications with the patient, except to reassure him.

2. *Purulent Meningitis.* This is due to a faulty technique, just as is the infective peritonitis that follows a clean laparotomy. It is the same risk of sepsis encountered in every surgical case. The symptoms show themselves, usually, during the first twenty-four to forty-eight hours. Headache and restlessness are followed by the characteristic signs and symptoms of infectious meningitis. Lumbar puncture will usually show a turbid spinal fluid. The pressure will be abnormally high and the cell count and globulin content greatly increased. The literature for the last twenty years shows only 9 such cases with 2 deaths. As a rule the meningitis tends to clear up spontaneously in ten to fifteen days with no after effects. The best treatment, available is the following:

(a) Frequent decompression lumbar puncture.

(b) Hypertonic solution, intravenously, which tends to clear up the intense headache and other symptoms when nothing else will. Use 30 per cent glucose in physiologic salt solution and give about 200 c.c.

E. NEURITIS AND THE PALSIES

The neuritis or palsy following spinal anesthesia is also rare. When it does occur it should cause little anxiety because it clears up spontaneously with no after effects. The one exception is the sensory or motor paralysis due to trauma of the nerve roots. This is due to difficulties in performing the lumbar puncture and may be permanent. The palsies may be divided into two classes:

Types.

1. *Due to Trauma at Site of Puncture.* Here we find the motor or sensory terminal disturbances due to the spinal needle hitting the spinal roots or the nerves of the cords equina. There may be sharp, shooting pains, muscle spasm, anesthesia in the lower extremities, transient paralysis or irritation of the vesical or anal sphincters. These are due to a slight trauma of the nerve roots and will usually clear up within a few days with no later complications.

When the nerve roots are more severely damaged there will be a more lasting anesthesia or paralysis. When the continuity of the nerve roots is severed there will be permanent damage. Unlike the puncture of a nerve root, the puncture of the cord usually causes neither pain nor after effect. Fortunately organic cord changes do not come on later in life following spinal anesthesia. On several occasions patients with organic cord lesions have tried to prove that these lesions resulted from spinal anesthesia. A search of the literature revealed only 2 cases where, after a thorough neurological examination, such a claim, following a lumbar puncture could be justifiable.

2. *Due to Damage at a Distance.* These are the later palsies. They are limited to the extra-ocular muscles and usually to the muscle supplied by the abducens nerve. If it occurs it ordinarily appears during the second week after the operation. The first symptom is slight photophobia, followed by diplopia which is very annoying to both the patient and the surgeon. One or more of the symptoms of meningeal irritation

usually accompanies the ocular symptoms. After about ten days the paralysis retrogresses and clears up spontaneously by the third or fourth week. It is not known why this particular nerve should be involved. The more important theories are:

(a) This nerve may have a special susceptibility to the drug.

(b) Because of its long passage through the spinal fluid, it is more exposed than the other nerves or nerve roots to the drug or the spinal fluid contaminations, e.g. capillary hemorrhage, air bubbles, foreign bodies, etc.

It is the author's belief that this is one of the symptoms of a low-grade meningitis or meningismus and that it can be eliminated by using sterile solution, better technique and better postoperative care.

The neuritis or pain in the back and lower legs may be the result of slight trauma by the needle to the skin or meninges or to bruises or strains occurring at a time when the patient is unable to react to any cramped or uncomfortable position. They clear up in a few days and should cause no grave concern.

F. NAUSEA AND VOMITING

With the exception of cases in which it is necessary to place the patient in the Trendelenburg position or to pack off the upper abdomen tightly, nausea and vomiting occur only where there have been errors or omissions in the procedure. Nausea and vomiting as complications of spinal anesthesia are in no way related to the nausea and vomiting resulting directly from operative manipulations or from pre-existing pathology. Moreover, there is no severe postoperative nausea and vomiting after spinal anesthesia alone. There may be several different causes for these symptoms during a spinal anesthesia, the majority of which can be eliminated. They are:

Causes and Treatment

1. *Cerebral Anemia.* The nausea and vomiting from cerebral anemia occurs during the first fifteen minutes of the anesthesia or when the patient is suddenly moved. It may be merely the slight nausea which is a concomitant of low blood pressure or it may go on to severe vomiting. It can be prevented or readily stopped by the methods used for treating a vasomotor collapse. Frequent deep breaths or a drink of spirits of ammonia will usually stop it. Some advise the more rapidly diffusing vasomotor stimulants such as nitrous oxide or ether. The author has found that oxygen inhalation, wet towels applied to the face, exaggerated breathing, the initial hypodermic of adrenalin and elevation of the head and shoulders are sufficient to prevent or relieve this type of vomiting.

As in all other cases of cerebral anemia the head and shoulders must be flat. The patient should be placed in the Trendelenburg position and be treated as outlined. Further collapse must be guarded against.

2. *Psychic Nausea.* This type of nausea is the result of certain mental impressions. The patient may be reacting perfectly well to the operation and be showing no signs of either pain or excitement and then become suddenly extremely nauseated, vomit and extrude the viscera through the abdominal incision. These upsets commonly follow lack of preoperative morphia and poor psychology on the surgeon's part. Such questions as "Does it hurt?" and "You must be quiet now and help us" are rather suggestive. This nausea is the result of the terrifying thoughts of an overactive mind which are often intensified by the thoughtless questions of a busy surgeon. The attack is very similar to that which occurs when one first sees human blood, mutilated bodies, etc. Those who have tramped the battlefields of France will testify that this is possible. Sufficient morphia, and an entertaining and cooperative anesthetist will eliminate this complication.

3. *Reflex Vomiting.* We know that thoraco-abdominal paralysis, causing excessive action of the diaphragm in breathing, a sudden change in the position of the patient, packing against the stomach,

and manipulation of the stomach and duodenum, all interfere with the normal function of the stomach. This dysfunction added to an already existing slight cerebral anemia is often sufficient to start a reflex vomiting. It should be guarded against but when it does occur it may be promptly relieved by discontinuing the irritation and combating the anemia of the medulla.

4. *Postoperative Nausea and Vomiting.* This may develop as an accompaniment of the spinal puncture headache or may be one of the symptoms of a meningeal irritation or infection. The nausea and vomiting are not ordinarily severe and will clear up as the other condition improves.

G. HEADACHES

Though the vasomotor collapse is the most feared, the persistent headache is the most annoying complication of spinal anesthesia. Its frequency has discouraged many who have tried this form of anesthesia. These headaches have a definite etiology. They can be prevented in more than 95 per cent of the cases and when they do occur they can be quickly relieved. Since the various types can be easily differentiated, one will save himself from many inconveniences if he will but use simple preventatives and be exact in his treatment.

1. *Lumbar Puncture Headache.* It is the most common headache following spinal anesthesia and is characterized by a pathognomonic set of symptoms and a definite treatment. It is not dependent upon the blood pressure of the patient and it may occur regardless of fluid removed. A later lumbar puncture will show that the spinal fluid pressure is lower than it was at the time of the anesthesia and an examination of the fluid will show a decrease in the cell count and globulin content. The patients usually complain of an occipital or a parietal headache which appears during the first twenty-four hours after operation and which gradually increases in severity. The headache is worse when the head and shoulders are

raised but completely disappears when the head and shoulders are lowered. No drug gives sufficient relief to allow the patient to sit up and do any form of work.

When the physiology of this headache is understood and atraumatic induction is practiced, it can be eliminated. The following important points should be kept in mind:

Precautions

(a) Keep the patient perfectly quiet while the spinal needle is being inserted. This will keep the needle from tearing a slit in the dura.

(b) Use a very small spinal puncture needle.

(c) Keep the patient in shock position for twenty-four hours after operation. Be sure that during this time the patient's head is always at a level lower than his pelvis. This allows a clot of fibrin to form over the hole in the dura, preventing leakage and thus preventing the headache. Without this treatment the headache, if it appears, lasts seven to ten days while the aperture closes by the normal healing process of tissue.

If the patient develops this headache after the foregoing precautions have been observed, or has a headache which fails to clear up, look for other causes. If none are found proceed as follows:

Treatment

(a) Lower the head for another twenty-four hours.

(b) Completely eliminate all forms of stimulation and excitement.

(c) Give 1 ampule of surgical pituitrin, or ephedrine hydrochloride, $\frac{3}{8}$ to $\frac{3}{4}$ grain, intramuscularly; this may relieve the mild cases.

(d) The more severe cases can often be relieved by a hypotonic saline solution given intravenously. Give about 100 c.c. of a 0.5 per cent sodium chloride solution. It may be painful for a few minutes, but this pain will be much less than that due to the headache, which it will relieve within twenty to forty minutes.

(e) Do not do a lumbar puncture as it will make this type of headache worse.

(f) Force fluids. Give one glass of water every hour by mouth. If this cannot be done give 1000 c.c. every six hours by the Murphy drip method.

2. *Meningitic Headache.* If a pure drug has been used this complication is a result of poor technique in administration. This headache is entirely different from the lumbar puncture headache and it is one of the symptoms of post-anesthetic meningitis or meningismus. It results from meningeal irritation and is due to the increase in the spinal fluid pressure and occurs with the stiff neck, photophobia or other symptoms of meningeal irritation.

Although made worse by raising the head and by exercise, it is not relieved to any extent by lowering the head and it is relieved by an ice cap, aspirin or morphine. A lumbar puncture shows an increase in spinal fluid pressure and an increase in cells and globulin content. There may be the pathological picture of an infectious meningitis or that of exudation due to irritation. The headache will clear up if the meningeal condition improves. Persistent headache from this cause may be relieved by the following measures:

Treatment

(a) Keep the patient flat in bed with an ice cap on the head.

(b) Eliminate excitement and all stimulating drinks.

(c) Make frequent lumbar punctures to relieve the spinal fluid pressure.

(d) Give diuretics, cathartics and hypertonic solutions by mouth and intravenously, if necessary. The intravenous infuson of 10 per cent glucose in physiologic salt solution will relieve the headache if nothing else will. As much as 1000 c.c. may be given and it may be repeated after six to eight hours. This is one of the best diuretics.

3. *Meningeal Reflex Headache.* This is the mild headache which occurs two or three hours after the spinal injection and is usually gone by the end of the third postoperative day. It results from meningeal irritation, especially when a large needle has been used or when there has been difficulty in entering the dural canal. It is not serious and occurs infrequently in the hands of experienced surgeons. It will cease spontaneously within a few days and is readily relieved by mild sedatives or morphine.

It should be realized that most of these headaches are the result of errors in technique and that they are excellent symptoms for the neurotic to enlarge upon. The etiology should be sought for so that recurrences may be prevented. Common causes are injected air bubbles, punctured veins, traumatized tissues, or puncture with needles of too large caliber.

RECAPITULATION

The complications of spinal anesthesia have been thoroughly discussed, not to precipitate fear of this anesthesia but to show that severe complications can arise if we are lax in our technique or are not always vigilant. Alarming complications are conspicuous by their scarcity and infrequency. We see very few after-effects of this anesthesia. These are chiefly dependent on the fall in blood pressure, which itself can be controlled as described. The two most serious complications of spinal anesthesia in the past have been spinal puncture collapse and respiratory failure. These have become vary rare indeed since the modern methods of administering spinal anesthesia have been more widely adopted and its users have gained greater experience.

INHALATION AND COLONIC ANESTHESIA[*]

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INHALATION anesthesia, without preliminary medication, the first and crude pioneer method of alleviating pain for surgical operations, is being quietly and gradually displaced by the more modern, safer and saner methods that preclude the possibility of fright (and occasionally death from fright); methods that maintain a normal blood pressure, except of course during certain necessary surgical procedures; methods that do not interfere with the physiological balance between respiration and circulation, methods that return a patient to his bed in a pain-free condition and without nausea and vomiting. Local, spinal, paravertebral, regional, parasacral, caudal, anoci-association, each when used with the proper preliminary medication, do these things.

As compared to spinal anesthesia, to one who is thoroughly acquainted with both methods, rectal anesthesia is unquestionably the safest. The fact also that the time period before any sedative is required is usually three hours or more, is to the credit of rectal anesthesia. Spinal anesthesia is in itself a surgical operation, requiring special technique and the usual precautions taken with all surgical procedures. Spinal anesthesia will be greatly improved when all patients are preliminarily medicated to such an extent that they are indifferent or oblivious to their surroundings. But even with this improvement, rectal anesthesia when thoroughly understood is safer and from many standpoints superior to the spinal method. ·

Inhalation anesthesia, per se, even with nitrous oxide or ethylene and oxygen, is an unphysiological procedure. Why? Because when you place a mask upon the face of the patient, even with the best technique, hyperpnoia to a greater or lesser extent ensues. (Compare respiratory rate on Frazier's charts, Figs. 3 and 4.) This load is immediately thrown upon the heart and if the operation lasts over an hour, symptoms of exhaustion and shock to some degree will appear. Usually the patient recovers from these symptoms. The fact that thousands of operations have been done in well known clinics under inhalation anesthesia without preliminary medication, and seemingly with no ill effects from this procedure, does not prove the contrary view. Lowsley and Rogers[1] in a classic paper, show that when inhalation anesthesia is used *unusual hemorrhage* occurs in 31 cases as compared to 6 cases with regional anesthesia. Shock occurs in 23 as compared to 3; complications are 24 to 13; postoperative days are 33 to 22.7, and finally, the number of deaths is 14 as compared to 3.

This comparison of inhalation to regional, in my opinion, is applicable to all the other methods mentioned above and also to colonic anesthesia.

The laboratory experiments of Gwathmey and Hooper[2] showing that when preliminary medication is omitted, lung lesions occur that do not occur when preliminary medication is given (the animals receiving all inhalation agents; nitrous oxide, ethylene, ether, etc.), indirectly proves Lowsley's work and suggests the idea that the best method for using inhalation anesthesia is merely and only as a supplement, preceded by a safe preliminary medication that will produce relaxation and indifference on the part of the patient to his surroundings or complete unconsciousness.

Colonic anesthesia, embodying in itself both the preliminary medication and the final anesthetic agent, from any and every

Fig. 1. Comparison of rates of evaporation of different mixtures of olive oil and ether. (Baskerville) "Anesthesia," Gwathmey, J. T., N. Y., Macmillan, p. 441.

standpoint is fully entitled to rank with the methods mentioned above, which are superior to the crude inhalation method first used over eighty years ago.

History. This has been well written by Sutton.[3] Corrections only are in order. Oil-ether colonic anesthesia was an indirect evolution of Honan's[4] demonstrations of *intravenous* anesthesia. The experimental laboratory animal work was conducted under the immediate supervision of Professor Wallace of the Pharmacological Department of University and Bellevue Medical College. Here it was proved that:

1. This method was unsatisfactory unless preceded by morphine.

2. Respiration, pulse and blood pressure are as evenly and safely maintained in

the dog with this method as with any other known method of producing anesthesia.

About the same time, the late Professor
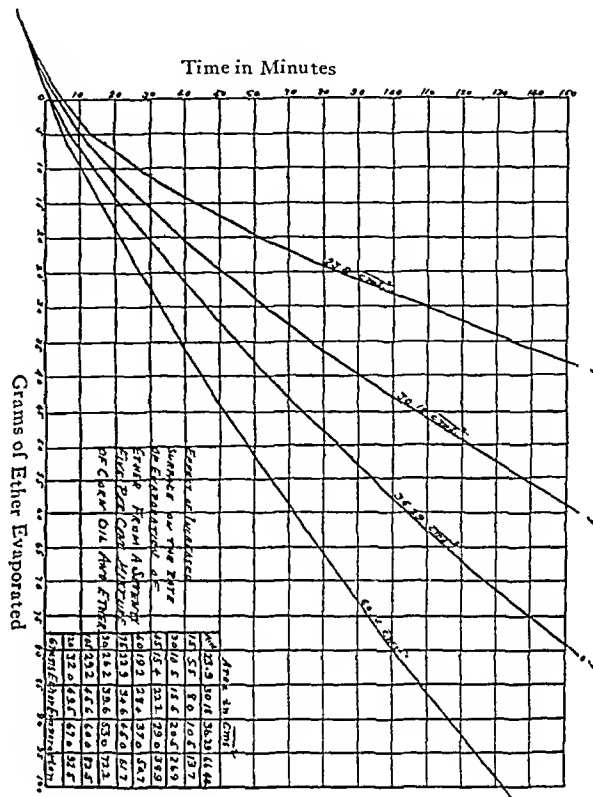
Fig. 2. Effect of increased surface on the rate of evaporation of ether from a 75 per cent mixture of corn oil and ether. (Baskerville) "Anesthesia," Gwathmey, J. T., N. Y., Macmillan, p. 441.

Charles Baskerville, at my request, experimented and proved by thousands of experiments in the chemical laboratory of the College of the City of New York, that regardless of whether the oil was animal, vegetable or mineral, or whether a 25, 50 or 75 per cent ether mixture was used, the rate of evaporation remained constant.

These charts giving the percentage of ether evaporation during two and one-half hours, show that as far as this factor is concerned oil-ether, colonically, is a safe procedure, admitting of an absolutely even plane of anesthesia, *which would not be the case if the ether evaporated irregularly, either in point of time or quantity.* The charts show, furthermore, that the patient does not absorb a tremendous amount of

ether immediately upon injection, which would result in anesthetic shock, but that he becomes anesthetized gradually in ethyl chloride parts from the oil at one time. In the animal laboratory, ethyl chloride was mixed with oil and placed in
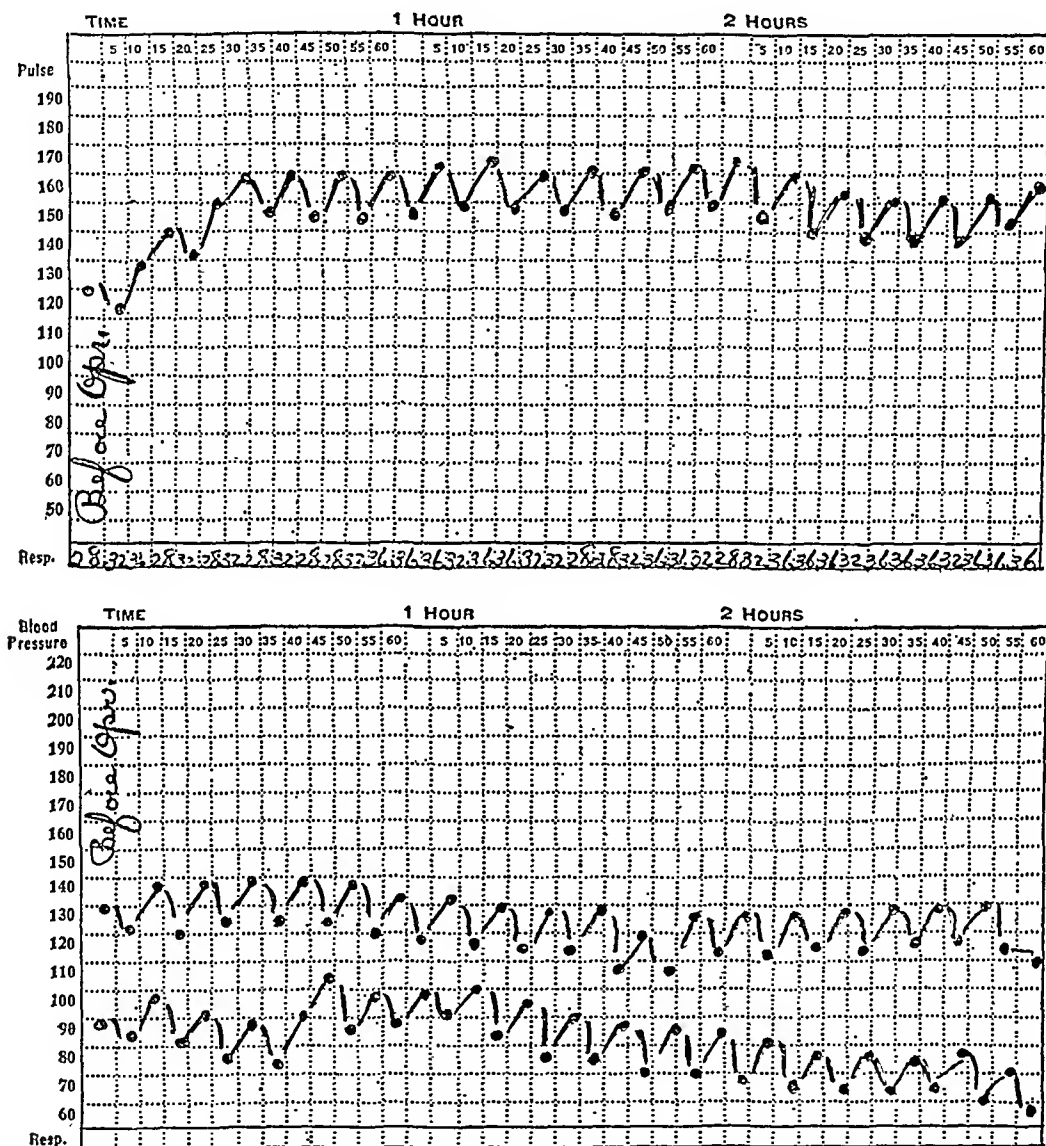
FIG. 3. A. H. C. Operation, second stage craniotomy, February 2, 1927. Operator Dr. Frazier. Operation started 9.10 A.M. Operation ended 12.10 P.M. Anesthetic, local and ether. Open method. Anesthetizer, L. A. Hitz. Total amount used, ether 6 oz. A. S. gr. 1/150 B. Anes. Patient fair condition. (Courtesy Neurosurgical Clinic of the Hospital of the University of Pennsylvania.)

accordance with the constancy of evaporation of the ether from the mixture in the colon.

Experiments were tried both in the chemical and animal laboratories, with one drug that does not evaporate evenly from an oil mixture, i.e., ethyl chloride.

In the chemical laboratory all of the the dogs colon as an initiatory anesthetic to oil-ether (in the same way as it is used in inhalation, i.e., as an introduction to ether anesthesia) but all of the ethyl chloride came off at one time and killed the animal in less than five minutes.

In the laboratory of the Department of Health of the City of New York, experi-

ments were conducted by William H. Park on the bactericidal action of oil ether mixtures using 5, 10, 20 and 30 per cent coli with two and one-half minutes exposure in tubes of broth. Since infection from the colon bacillus is to be reckoned with in
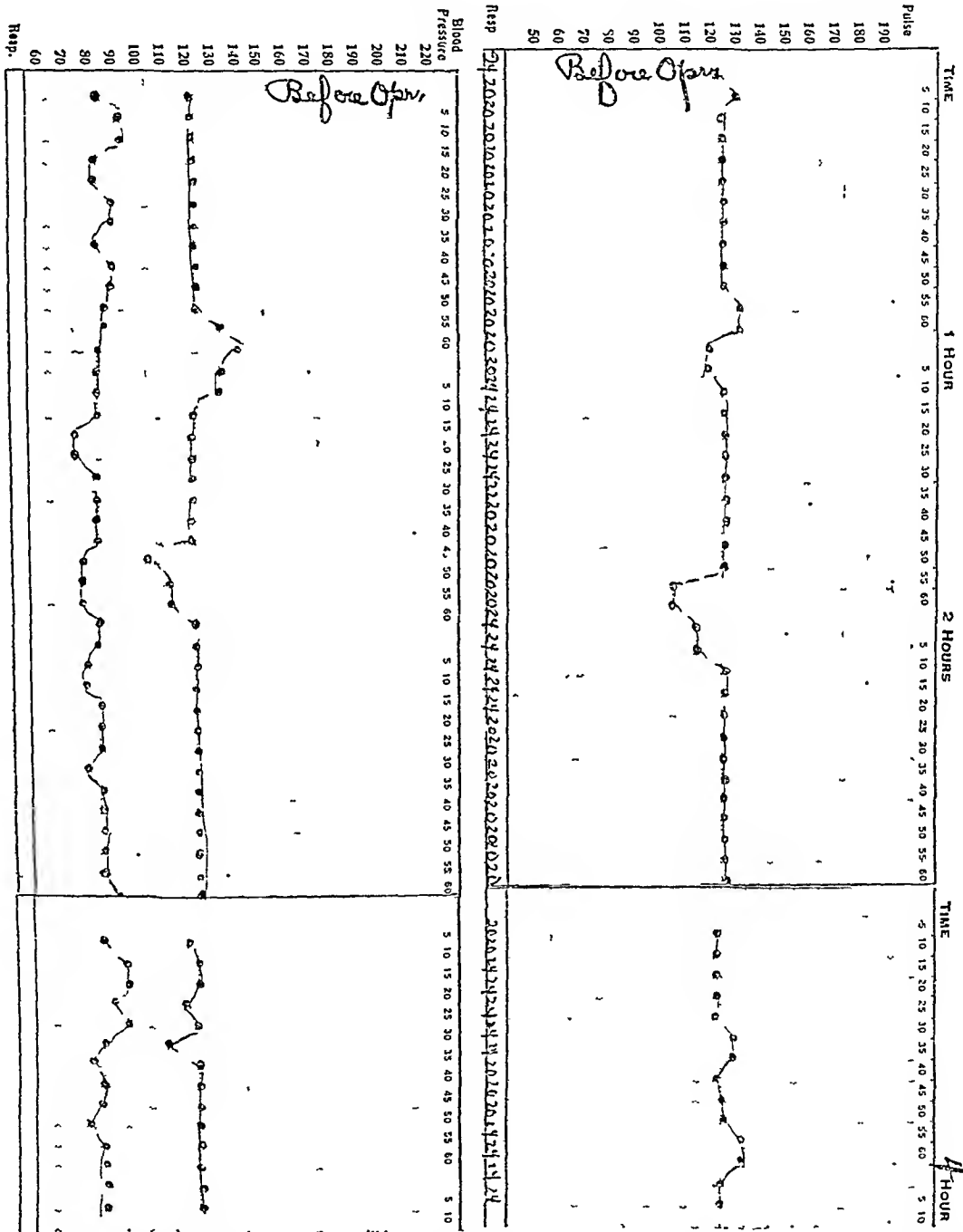
FIG. 4. A. H. C. Operation, third stage craniotomy, removal of tumor, April 25, 1927. Operator Dr. Frazier. Anesthesia started 8 45 A.M. Operation started 9 35 A.M. Operation ended 1.30 P.M. Anesthesia, colonic. Anesthetizer L. A. Hitz. Total amount used, ether 6 oz., olive oil 6 oz. A. S. gr. 1/150, 8.15 A.M. No inhalation anesthesia. Patient good condition. (Courtesy Neurosurgical Clinic of the Hospital of the University of Pennsylvania.)

mixtures against the Bacillus coli. These tests showed that 10 to 20 per cent oil-ether mixtures killed practically all B. many surgical operations, this fact is reassuring. It was only after many animals had been used and ten consecutive charts

(and examination of the animal's colon later) had proved conclusively that this was a safe procedure, that the method was attempted upon human beings.

Thus it will be seen that nothing in medicine or surgery was ever more carefully investigated and completely controlled before being tried clinically than was oil-ether colonic anesthesia.

Clinical Results. The clinic is the final test for all laboratory work, tending to improve on present methods. The best judges of clinical work are those who have used and are using this method as a routine and successfully. The English surgeon, Pickerill[5] states:

For extensive or prolonged facial or jaw cases, such as a large bone graft, I much prefer rectal anesthesia to any other. I have now for the past six years had a fairly extensive experience of the new method and I have never had cause for a moment's anxiety on its account. Neither have I seen any undesirable after-effects.

W. I. deC. Wheeler,[6] also an English surgeon, states:

In my own practice, ether by the colon is used almost as a routine for operations about the head and neck. The comfort of a field free from the paraphernalia employed for inhalation anesthesia cannot be exaggerated. It is a method par excellence for excisions of the tongue or jaw and for removal of goitre or glands of the neck.

In the Kessler-Hatfield Hospital in Huntington, West Virginia, it is used for all operations lasting over forty minutes. There it has been used over 3000 times. One of the surgeons, Dr. Hatfield, in a personal communication to me states:

I think it is the safest; I consider it first among the many methods of anesthesia. Unquestionably, there is less reaction, less shock and less possibility of anesthetic complications by the rectal method than by any other known to surgical science . . . Shock has been reduced to a minimum, our pneumonia cases have disappeared altogether and no complications have arisen since we adopted this method of anesthesia.

Meyer, one of the surgeons at the Skin and Cancer Hospital, New York City, and Robins,[7] at that time an interne at the same hospital, after using oil-ether used as a routine for many years, stated that it is:

Probably one of the safest methods of administering a general anesthetic known at the present time. If the test of safety is the freedom from ill effects in admittedly bad surgical risks, then colonic anesthesia has earned its right to be so considered, for in the experience of the New York Skin and Cancer Hospital, where so many of the patients are elderly persons with advanced visceral changes, and the debilitating consequences of their carcinomatous conditions, it has been found that the recovery from operation has been unusually free from the sequelae that seemed formerly to be an unavoidable sequence of operations in these cases . . . The margin between full surgical anesthesia and a toxic dose is greater with colonic anesthesia than with any type of inhalation anesthesia.

The routine method used at the Skin and Cancer Hospital, which was developed by George Semken especially for careful dissection of malignant growths, where the element of time can be disregarded, is as follows:

Ether. The amount used varies between 2½ and 6 oz. (between 75 and 180 c.c.) the most frequent dosage being 4, 5 and 6 oz. (120, 150 and 180 c.c.)

Paraldehyde is constant, 2 drs. (7.5 c.c.).

Olive Oil is one half the quantity of ether used.

STANDARD FORMULAS, SKIN AND CANCER HOSPITAL

Ether...........	4 oz.	5 oz.	6 oz.
Paraldehyde......	2 dr.	2 dr.	2 dr.
Olive oil.........	2 oz.	2½ oz.	3 oz.

(For details of technique, see article by Meyer and Robbins[7])

The late Walter Lathrop, Chief Surgeon of the State Hospital at Hazelton, Pennsylvania, and his associate and successor, R. A. Gaughan, after using the above colonic technique over 2000 times, developed the following technique which is especially suitable for goiters and which

has been used in many thousands of cases:

First injection, one hour before operation
Morphine sulphate,   grain ⅙
Novocaine,   2½ per cent
MgSo₄, 50 per cent solution, 2 c.c.
Repeat twice at fifteen minute intervals.
Rectal instillation, twenty-five minutes before operation

> Ether,   1 to 1½ oz.
> Olive oil, 4 dr.

Novocaine for skin and peritoneum.

Thus each patient gets ½ grain of morphine and 6 c.c. of a 50 per cent solution of magnesium sulphate.

The Skin and Cancer Hospital technique calls for a minimum of morphine and the maximum quantity of ether and is especially suitable for prolonged cases. The Hazelton technique calls for the maximum amount of morphine and the minimum amount of ether and is especially suited for cases where the cooperation of the patient may be necessary. The analgesia is the same as with the much larger amount of ether formerly used but is of shorter duration. Dr. Lathrop stated that he had had neither a death nor even a scare with this method of procedure.

Frazier,[8] Professor of Surgery in the University of Pennsylvania, states that:

> In colonic anesthesia we have a method of inducing narcosis in which there is none of the sense of suffocation, no period of excitement, no harmful influence upon the pulse or blood pressure, no irritation of the upper air passages, a state of analgesia after consciousness has returned, a narcosis of uniform depth, the ether vapor is always warm, there is less post-operative nausea and vomiting, the amount of ether in the system is a fixed known quantity.

In Frazier's article he gives a number of charts showing the pulse and blood pressure of a number of patients operated upon for the removal of brain tumors, suboccipital craniectomies, subtemporal decompressions and laminectomies. Four of these charts are reproduced here, showing the very great difference between a patient under ether inhalation anesthesia and one under colonic anesthesia. The principal fact to be noted in these charts is that with inhalation anesthesia the respirations are 28 to 36, whereas with oil-ether, the respirations are 20 to 24. With every other chart in this series under colonic anesthesia, the respirations are 20 to 24.

G. B. New, of the Section of Laryngology and Plastic Surgery at the Mayo Clinic, in a discussion of Dr. Lundy's[9] method of using oil-ether colonic anesthesia states among other things that "it has always been a problem to keep the adult patient with a cleft palate asleep with a general anesthetic during the operation. While block and local anesthesia have constituted a distinct improvement upon the drop method, colonic anesthesia has been found still better and is used entirely in this group of cases."

Lundy states:

> I have not hesitated to use oil-ether colonic anesthesia in cases where there was a solitary kidney apparantly in good condition, and I have used it frequently when cauterization and diathermy of various parts of the mouth and tongue were to be carried out without packing off the pharynx.

As colonic anesthesia is still a mystery to many surgeons it might be pertinent to state certain fundamental facts. In the hands of one who understands the technique and the difference between the signs of analgesia and surgical inhalation anesthesia, it is unquestionally the safest of all known methods of general anesthesia. It is necessary to give at one time the total amount as determined by age, weight and general condition of the patient in order to establish the ether tension in the blood which is required to produce anesthesia. As long as the mixture is in the rectum or sigmoid it is practically in a container outside of the body. The physiological effect results only when the ether gets in the blood stream. The evaporation, absorption, and eliminatiion are automatically maintained by certain inflexible

physical laws that maintain blood pressure, pulse and respiration in their normal ratio. The patient absorbs and eliminates 1½ to 2 oz. of ether per hour, depending somewhat upon the patient's condition and the surgical operation. The rate of absorption is at the rate of 1½ to 2 oz. per hour. As the ether separates from the oil a frigidity occurs which slows up the evaporation; also, as the ether evaporates it distends the gut and absorption is slowed up. The mixture is automatically heated constantly to body temperature, a small amount of ether released from the oil and a frigidity again ensues. (This can be understood by observing the frost on the outside of a nitrous oxide tank as it approaches exhaustion.) During this time, however, the temperature of the patient remains normal as determined by a thermometer placed in the mouth or axilla. The skin is warm to the touch. The color of the face suggests thorough oxidation at all times. The cold clammy sweat so often noticed with ether given by inhalation does not occur. Quiet respiration, so natural that not even the alae of the nose move, indicates there is no strain upon the respiratory center at any time. When the mixture is withdrawn and the anesthesia so terminated, the patient merges into a deep sleep from which he gradually awakens as from a natural slumber. The absence of nausea and vomiting and the fact that in some hospitals this method is used only in desperate cases in which inhalation anesthesia might be dangerous, would indicate there is less toxicity in connection with oil-ether anesthesia than with the usual inhalation methods. It is especially indicated for the very obese and alcoholic regardless of the nature of the operation. It is also best in all methods in surgery of the upper air passages. It is contraindicated in diseases of the rectum, colitis and fistula. Heart, kidney or lung disease do not contraindicate this method. Nausea, shock and vomiting are rarely seen when it is properly given. All medication preliminary

to oil-ether, including the hypodermic and rectal instillation, can be done by any capable nurse, the anesthetist taking charge of the patient fifteen to twenty minutes before being brought to the operating room.

A few fundamental rules are applicable to all methods of technique. A laxative should *not* be given. One soapsud and two clear water enemas the night before operation are usually sufficient. At bed time veronal or medinal, grains 10.

Day of operation: Two hours before time set for operation, give a low clear water enema and have patient to go to the toilet for the last time. Arrange lifting sheet to include shoulders and buttocks. Exclude all visitors, darken room, allow no talking, but tell patient to try to go to sleep. From this time on the technique differs in different hospitals. One and one-half hours before operation, place patient on *left* side, insert 22 F. catheter at least 6 in. within rectum and allow ten minutes for the following retention enema:

> Morphine sulphate, grain ¼
> Paraldehyde,   drams 2
> Chloral hydrate, grains 10
> Ether,   oz. 1
> Olive oil,   oz. 1

Clamp tube and allow to remain in place for forty minutes, until the second instillation is given, as follows:

> Ether,   oz. 3
> Olive oil, oz. 1

which should also take about ten minutes. During this time and from ten to fifteen minutes afterward, make pressure on perineum with towel, after which time any desire to expel the enema will have passed. The patient may now be allowed to lie in the position which is most comfortable. Quiet must be maintained. Place moist cotton in ears and cover face, including mouth and nose, with a warm moist towel. If in a ward, the bed should be

screened. If in a room, lower the shades and close the door.

When the patient is placed on the table, a wide strap should be buckled just above the knees and the hands should be secured by the sides. An occasional exclamation or slight movement is *not* an indication to supplement the anesthesia. Continued, uncontrolled movement *is*. The patient is more analgized than anesthetized. Occasionally he may talk while being operated upon. If supplement is needed it is never necessary to induce deep surgical anesthesia with automatic respiration. Novocaine for skin and peritoneum or a few drops of ether or chloroform, or nitrous oxide with 50 per cent oxygen, to quiet the patient, is all that is necessary.

The patient is returned to bed, the colon is flushed with a couple of quarts of tepid water. This takes away any of the anesthetic agent which may remain. Four to six ounces of warm black coffee may then be given as a retention enema. If patient is awakened by this procedure, he will soon doze off again in a natural sleep without the aid of narcotics and is usually comfortable for one or two hours afterward and awakens in an analgesic state.

CONCLUSIONS

The removal of psychic shock, the small amount of anesthetic used, the absence of cyanosis and asphyxial elements, the maintenance of normal blood pressure, pulse and respiration, the decrease in nausea, vomiting and gas pains, are sufficient reasons for using one of the various techniques of oil-ether colonic anesthesia.

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SPINAL ANESTHESIA IN OBSTETRICS*

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SPINAL anesthesia in all fields of surgery has several definite advantages, among which are: Complete analgesia; entire relaxation of skeletal musculature; preservation of tone of visceral musculature; absence of respiratory, cardiac, hepatic and renal irritation; minimal penetration of shock impulses to cerebral cortex; lessened bleeding during operation; relative freedom from postoperative nausea and ileus; immediate postoperative ability to ingest nutriment.

In obstetric surgery all of these advantages are equally important as in other branches; some of them more important. The preservation of uterine tone lessens the tendency to hemorrhage during and after the third stage. The relaxation of skeletal muscles reduces the risk of laceration of soft parts. The absence of renal and hepatic irritation is especially significant in pregnancy, which state so frequently makes inordinate demands on the functional capacity of liver and kidneys. The preservation of the patient's consciousness permits a degree of voluntary co-operation by the patient, which is required in few circumstances pertaining to other types of surgery, but is very helpful in obstetrics.

Of especial moment is the fact that spinal anesthesia has in no sense or degree any deleterious effect on the fetus. There has been no case in our experience in which asphyxia or death of the fetus was even remotely attributable to this anesthesia.

The advantages pointed out as of general application to all obstetrical patients are even more important in the delivery of those exhibiting hepatic or renal toxemias. In spite of the great recent refinement in the choice and administration of inhalation narcotics, the researches of Stander and others confirm the fact of the potential damage to liver and kidneys inherent in all such agents. No such potentiality resides in spinal anesthesia and it is in these classes of cases especially that it becomes preeminently the anesthesia of choice.

It is also most helpful in cases in which cardiac insufficiency complicates pregnancy or labor; here the elimination of all shock and the relief to the laboring heart by the lowering of blood pressure tend greatly to minimize the extreme urgency of many of these cases.

In acute or chronic disease of any part of the respiratory tract spinal anesthesia absolutely eliminates local irritation. As obstetrical surgery is never elective in point of time with reference to the course of such diseases, the availability of this method becomes an important factor in handling these cases with a minimum of risk.

Our experience has not led us to recognize any serious disadvantages. Blood pressure fall, formerly much dreaded in connection with its use, has ceased to occasion anxiety. This depends partly on the use of ephedrine to combat hypotension, but more importantly on the fact that the limited area of anesthesia necessary in any type of obstetrical operative procedure permits the use of the anesthetic agent in doses so small and at so low a level, that the danger from lowered blood pressure is almost negligible apart from the use of any medicinal agent to offset it.

The short duration of anesthesia, averaging about three quarters of an hour, is rarely of moment in obstetrical procedures, most of which can easily be completed within this time. Vomiting occurs occasionally, but is rarely severe or protracted.

In only 1 of over 400 cases was this a distressing symptom.

Postoperative headache does occur, being referred principally to the vertex and the suboccipital region; it is occasionally severe and is rarely protracted for several days; we believe it can be almost wholly prevented by care in technique and the proper selection of needles.

Subjective apprehension is occasionally encountered, especially when the patient has anticipated relief by inhalation narcosis; such apprehension is readily amenable to suggestion, however, and disappears when the patient experiences the prompt and complete disappearance of her pain. Some patients exhibit mental disturbance because of the paresthesia of the lower extremities which is common, but these may be easily reassured. In practically all cases the final psychic impression is favorable, often extravagantly so, especially in patients who have had previous experiences with other methods of anesthesia.

In only 1 of our cases was there any persistent unpleasant sequel; this was a mild paresthesia of one thigh, lasting four weeks.

There is, of course, a certain dexterity to be attained and certain details of technique to be observed, failure in which will make for unsatisfactory results. But inasmuch as this holds true in applying any method of anesthesia it is of no especial force relative to spinal anesthesia.

The method is practicable and desirable for routine use in all types of operative obstetrics. We used to believe that arterial hypotension was a contraindication, but have practically abandoned this criterion, even in severely shocked patients, for both our own careful observations and those of others have shown that the blood pressure fall is proportioned to the initial blood pressure level; that is, where the initial blood pressure is high, the fall thereof following the spinal injection is considerable, whereas, if the initial blood pressure be very low, the further fall resulting from the spinal injection is negligible.

We also believe that spinal anesthesia has a restricted usefulness in the termination of the second stage of normal labor, a phase of the matter which is dealt with in material now in course of publication.

Our method of administering spinal anesthesia is a modification of that of Labat. We have found no advantage in the use of commercially prepared anesthetic solutions. For all procedures at the perineal level, low forceps extraction, episiotomy, perineorraphy—50 mg. of crystallized novocaine dissolved in 2.5 cc. of spinal fluid is injected into the fourth lumbar interspace. For other intravaginal operative manipulation—dilatation or incision of the cervix, forceps applications at the level of the inlet, breech extractions, podalic version, craniotomy and extraction, vaginal hysterotomy—50 mg. of novocaine in the third lumbar space is used. For obstetrical laparotomies we employ 100 mg. novocaine in the third lumbar interspace. All intraspinal injections are preceded ten minutes by one 50 mg. ampule of ephedrine sulphate hypodermatically. A skin-wheal is made with 0.5 per cent solution of novocaine before introducing the spinal needle.

The type of needle used is important. It should be of No. 22 or No. 20 gauge and may be of any material available. The conical-pointed needle of Greene is theoretically advantageous, but if it impinges against bone in its introduction, the point may split, resulting in a two-pronged point which cannot but lacerate the dura unnecessarily. We have come to prefer a sharp short-beveled needle, such as those of Babcock or Pitkin.

The injection is given the patient in the lateral prone posture, with legs and thighs well flexed and with the head bowed well forward. This is somewhat awkward, but can be accomplished by having an assistant steady and help the patient; on the whole, we think it is less distressing to a patient in the throes of labor than the stooped sitting posture. There is little difference between the two as to the facility of introducing the needle.

The latter is inserted exactly in the mid-

line, midway between the contiguous dorsal spines at the level selected, exactly perpendicular to both the sagittal and transverse body planes. If difficulty is encountered by impingement against bone before the spinal canal is entered, direction of the needle slightly more cephal-ward will usually overcome it. If it does not readily do so, it is usually best to withdraw and reinsert the needle. Usually the slight, but somewhat sharp elastic resistance encountered in penetrating the dura is recognizable, and serves to orient the point of the needle; if it does not, the needle impinges against the centrum of the vertebra and should then be slightly withdrawn. Sharp pain referred to either leg, or a flow of blood from the needle indicates that the point has been directed too much laterally; it should be withdrawn and reinserted, sometimes best at the next higher level.

The end results have been uniformly satisfactory except as above noted. The anesthesia ensues very promptly upon the injection, and passes off just as promptly. There is no post-anesthetic depression, distress, or disturbance of mental equilibrium. The method as applied to obstetrics is again offered, not in any sense as original, but as one deserving, in the interest of patients, much wider use than it has hitherto enjoyed.

POSTOPERATIVE PHASES OF SPINAL ANESTHESIA*

Frank C. McCormack, m.d.

ENGLEWOOD, N. J.

DURING the recent period of renewed interest in spinal anesthesia much has been written about the operative advantages of this ideal anesthetic but little has been noticed in the literature regarding the postoperative clinical aspect of the patient which is of great importance to the surgeon and greater importance to the patient.

For the past two years at the Pitkin Clinic we have made particular observation of the postoperative convalescence of all patients receiving the intradural anesthetic known on the market as spinocain. Our observations have convinced us that spinal anesthesia, in its present improved form, has many definite and proven advantages over any form of general anesthesia in the majority of surgical cases.

MENTAL ATTITUDE OF PATIENTS TOWARDS SPINAL ANESTHESIA

The patient receives the verdict of a necessary operation with less concern when assured that a general anesthesia is not going to be administered. We find that the patients accept their preoperative preparation with less apprehension and fear because of their knowledge that they do not "have to be put asleep." This mental attitude of the patient is a decided advantage, we believe, over the anxiety and psychical tension so often observed when the patient anticipates a general anesthesia. Many surgeons have stated that the patients are more frequently concerned about the inhalation of the anesthetic than they are about the operation. In clinics many patients who have taken spinal anesthesia several times request it in preference to general anesthesia.

PREOPERATIVE NUTRITION OF PATIENT

The preoperative fast and catharsis routinely carried out before a general anesthesia is unnecessary in spinal block except when contraindicated by the operation, namely in gastrectomies, etc. This added nourishment in the preoperative period is of marked advantage to the patient. There is no diminution in the supply of carbohydrates up to and during the operation. Fluids also can be given freely before and during the operative period. This point we feel is the explanation of the marked absence of postoperative acidosis, and alkalosis in spinal anesthesia. The normal fluid intake prevents dehydration and there is no secondary depletion of the blood chlorides as so often occurs following the surgical shock associated with inhalation anesthesia. The copious ingestion of fluids before and during the operative period certainly expedites the excretion of the excess nitrogenous end-products and tends to prevent the anhydremia that accompanies the toxemia of surgical febrile conditions. At this clinic the patient receives 4 oz. of orange juice and 4 oz. of 10 per cent glucose by mouth, every hour for three to six hours before the operation and 8 to 16 oz. of the same mixture during the operation.

DECREASE IN POSTOPERATIVE MORBIDITY

The absence of postoperative nausea and vomiting is particularly noted after spinal anesthesia in comparison with inhalation anesthetics. We have observed a striking decrease in the postoperative morbidity of our surgical cases. The absence or infrequency of presistent postoperative vomiting, profuse perspiration,

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605

abdominal distention, restlessness, agonizing thirst and parched mouth presents an entirely changed picture throughout wards and private rooms. The necessary limitation of food and liquid intake, immediately before a general anesthesia takes its toll in depleting the glycogen reserve in the liver and causing the heat energy of the body to be derived from the fat and protein of the tissue cells. The metabolism of fat in the tissues is incomplete when the carbohydrates coefficient is low and the toxic products of the partially metabolized fat appear in the blood as diacetic acid, beta-oxybutyric acid and acetone. The food and liquid intake as carried out in preparation for, during and after spinal anesthesia establishes a metabolic equilibrium not obtainable in the majority of cases of general anesthesia.

ABSENCE OF SURGICAL SHOCK

The complete absence of surgical shock following spinal anesthesia lessens to a marked degree the work and worry of the nurses, interns and attending surgeons. The pulse and blood pressure show little or no change during the hours following the operation except from a causative condition such as hemorrhage or in greatly debilitated patients.

DECREASE IN PULMONARY COMPLICATIONS

The irritation of the bronchial tubes produced by all inhalation anesthesia in a greater or lesser degree is avoided in intradural anesthesia. Postoperative bronchitis with its painful cough and annoying expectoration is not observed in patients who have had spinal anesthesia. Inhalation tents and steam kettles are no longer required to treat inhalation bronchitis so often seen when general anesthesia was used. Postoperative pneumonias which occasionally followed in the wake of upper abdominal operations have not been observed in over 600 cases of gall bladder and stomach surgery.

LESSENED MYOCARDIAL STRAIN

The cases of myocarditis, as diagnosed by the electrocardiograph, go through their operation with less jeopardy and a better prognosis under spinal anesthesia. The strain on the diseased myocardium produced by the labored respiratory efforts, increased pulmonary congestion and postoperative cough do not occur during or after spinal anesthesia. In fact the respirations are quiet and slow. The stabilized blood pressure eliminates the sudden relaxed arterial tension which in the early days of spinal anesthesia was much feared in myocardial disease. We have not had a mortality due to myocardial failure during or following spinal anesthesia. Under general anesthesia our past experience taught us that the myocarditis case was a very grave risk. Postoperative stimulation is rarely indicated as compared to the strychnine, digitalis, caffeine sodium benzoate and camphor therapy used so frequently after general anesthesia. No doubt the absence of surgical shock accounts for this favorable condition of the patient.

ACUTE GASTRIC DILATION AND ADYNAMIC ILEUS

The occurrence of acute postoperative gastric dilation was an infrequent but dreaded complication under general anesthesia. The number of gastric lavages given since the adoption of spinal and local anesthesia for all surgical operations is impressively less. Prolonged use and repeated manipulation of abdominal packs and retractors in the unrelaxed and heaving abdomen of inhalation anesthesia undoubtedly has had much to do with splanchnic shock and its resultant paralytic gastric dilation.

The marvelously relaxed abdominal walls and the collapsed state of the intestines which some French surgeon so fittingly spoke of as "abdominal silence" is obtainable under spinal anesthesia but

not under any form of general anesthesia. The stimulation of intestinal peristalsis and the relaxation of the sphincters as produced by the intradural injection of spinocain prevents adynamic ileus. The repeated colonic irrigation is now a rare agent in wards and rooms of hospitals using spinal anesthesia.

SUMMARY

The preoperative and immediate postoperative intake of carbohydrates and fluids made possible by a spinal anesthesia presents the patient as a better risk and prevents many postoperative complications. There is absence of surgical shock and a marked decrease in cases of postoperative nausea and vomiting. Spinal anesthesia is a great advantage in cases of hypertension, diabetes, nephritis, pulmonary tuberculosis, pulmonary influenza, pneumonias, eclampsia, and when patients are aged and debilitated. There is less urinary retention and no tendency toward urinary suppression as in general anesthesia. Cases of myocarditis are a much better risk under spinocain than under drugs used in the early days of spinal anesthesia or under general anesthesia. There is much less tendency toward postoperative gastric dilation and adynamic ileus. General behavior of patients is better both preoperative and postoperative than under general anesthesia. Mortality in over 4000 cases has been nil. Spinal anesthesia, as developed today, has renewed interest in and has advanced the ideal method for, surgical anesthesia of the future.

SPINAL ANESTHESIA IN ORTHOPEDIC SURGERY[*]

Fred H. Albee, m.d. and S. Oscar Fry, m.d.

NEW YORK

MANKIND is by nature conservative and skeptical. A new thought usually needs to be driven home by its originator or its advocates in person. Christianity, originated by a Jew, made progress in other lands only when it was directly expounded to the Gentiles, and, as often happens, the foreigner was more receptive. French philosophy of the eighteenth century, for example, found a more friendly soil, or at least came earlier to fruit, in the American colonies than in France itself. Lister interpreted Pasteur to the English much more easily than Pasteur could justify himself before the French scientists. Neither had an easy time and each succeeded only because he was able to show tangible and striking results. The human mind in the mass, even in the mass of those engaged in scientific pursuits, is youthful. It must see before it can adjudge.

In spite of the advantages which the modern press affords for the diffusion of ideas, it is often still necessary for a pioneer to carry his discoveries to other lands before his influence can be felt outside his immediate neighborhood. Sims and Ramon y Cajal are two in modern times; Jonnesco is another.

Jonnesco was not the first to use local anesthetics intraspinally, but it may be fairly claimed for him that he established the procedure as safe and reasonable. After having perfected a technique, he invaded the capitals of Europe and eventually came to this country to demonstrate how anesthesia may be induced without undue risk by a method which, up to his time, had been subjected to much criticism.

The method of anesthetizing the spinal cord has steadily improved since its inception and especially since Jonnesco's spectacular results. I have always been interested in the method and have felt confident that it would eventually find a place in orthopedic surgery. In 1927 I had a unique opportunity of testing its merits.

The visit of Jonnesco, and of Queen Marie later, had aroused our keen interest in Roumania, and of Roumanians in us. I was fortunate enough to receive an invitation from the Universities of Bucharest and Cluj to operate and lecture there. For each of the operations spinal anesthesia was induced by the Jonnesco method, so that I, who came to teach, was able also to learn. The completeness of anesthesia, the ease of operation and the absence of untoward results amazed me. There was no difficulty of any kind, even in the inlay operation for Pott's disease of the mid-dorsal region.

Since my return I have performed a series of operations on the lower extremities under spinal anesthesia. The series is not large enough to report in detail, but I have been able to draw certain conclusions. That there was no mortality is of little significance statistically; that there was no evidence of shock and vomiting in only 1 case (and that so long after operation as to be scarcely attributable to the anesthetic) was encouraging and reassuring in view of the results reported in past years. Like most orthopedic surgeons, I do not usually perform the first operation on the patient, especially in cases of repair and reconstruction. In orthopedic work, therefore, there is usually an opportunity for the patient to compare different methods of inducing anesthesia. In my series, the patients all preferred the spinal method, and, in one case, in which I had

to operate twice, the patient requested that spinal anesthesia be used again for the second operation.

There are well defined standards by which any method of inducing anesthesia is judged. It must be safe. None is without risk, but no anesthetic will meet with approval if it entails more risk than those in use. In spite of the difficulties that have had to be surmounted the record of spinal anesthesia is good. Large series have been reported with a mortality between that of chloroform and that of ether. Such large series must include many cases in which the technique of administration and the anesthetic used were not as conducive to safety as they are at present. Moreover, spinal anesthesia has been employed in many cases where the risk forbade the use of a general anesthetic. If an operation can be performed at all, in the presence of serious disease of heart, lungs, kidneys or metabolic system, it can be performed under spinal anesthesia. With the aid of adrenaline or ephedrine the effect on the vasomotor mechanism can be so minimized as to be less disconcerting than the effect of ether and certainly than that of chloroform, on the circulatory system. Properly administered, novocaine has no other toxic effect than that which adrenaline appears to be able to neutralize. In the face of certain adverse reports and a certain distrust which still lingers, one should not be too sweeping, but I am convinced that, when skilfully used, in a combination with adrenaline which may have to be adjusted to the individual case, novocaine injected intradurally will prove to be the safest of all known anesthetics.

An anesthetic must be easily administered. It is true there is the discomfort of the spinal needle, but the average patient will prefer that to the distressing feeling of losing consciousness under a general anesthetic. It does not take much practice to inject the dural canal, since the technique is fundamentally that of aspiration of spinal fluid. The anesthetist must be sure that his needle is in the dural canal

or he will not induce anesthesia; and that it is not in a vein or he will induce too much. Familiarity with the feel of the needle overcomes these obstacles.

From the standpoint of the orthopedic surgeon the qualification of any anesthetic, next to its safety, is its ability to induce muscular relaxation. Probably surgeons differ, but I do not work at ease unless relaxation is complete. I think most of us push anesthesia as far as we may with safety. Not only is it easier to operate in a relaxed joint, or on bones that are not distorted by muscular spasm, but it is easier to determine the nature of obstruction to free movement evident during consciousness. Muscular spasm disappears and the limitations of movement due to adhesions or malformations stand out clearly. To me, spinal anesthesia has this supreme virtue that it produces absolute paralysis of the muscles and permits maximal exposure of the field of operation in a joint.

To this advantage I should add another which both I and my colleagues have observed, although any comment which others may have made on it has escaped my notice. I refer to the hemostatic effect evident in the field of operation. It is true that we inject adrenaline subcutaneously in sufficient dosage to maintain the blood pressure, but one could not attribute hemostasis to adrenaline freely injected at a distance. If this phenomenon accompanies spinal anesthesia without the addition of adrenaline (and I have not investigated the problem), it might be suggested that paralysis of the spinal nerves to a part is accompanied by an exaltation of the vasoconstrictor mechanism in that part. The physiologists and pharmacologists will no doubt supply the solution.

The chief disadvantage of spinal anesthesia is its limitation to the surgery of the trunk and lower extremities. To the orthopedic surgeon, as well as to the neurological surgeon, that is a serious limitation. By "pumping" the spinal

fluid back and forth with his syringe, the anesthetist can cause the novocaine to diffuse widely through the dural canal, but he must not push the process too far. There does not seem to be any way of extending the method beyond its present scope.

Bone surgery is a pretty severe test of the courage of the conscious patient. Children and nervous patients are poor subjects. The former are too young to be influenced by reason and the latter approach the operation in too high a state of apprehension; neither can provide the cooperation essential to operation on a conscious patient. At the very outset comes the prick of the needle and the thin veneer of reassurance gives place to blind instinct.

Unfortunately children, especially those suffering from congenital deformity, provide their full share of orthopedic cases and chronic diseases of joints in adults are notoriously associated with reduced powers of resistance, both bodily and phychic. Repeated operation, deferred hopes and the fretfulness engendered by the deformities and restrictions of bone disease combine to deplete the morale of the average patient. More especially, if he has been reduced to dependence on others for help in his necessary activities, he comes to demand a special mitigation of the rigors of treatment for his benefit. He is an unlikely subject for any but complete anesthesia.

Much may be done to maintain the patient in a degree of equanimity during the operation. He is reasoned with, or reassured, or comforted or put on his mettle as occasion demands. Above all he is dealt fairly with, so that he knows what to expect. He should be diverted during the operation and never be questioned as to the amount of pain he suffers; his expression will reveal all the necessary information. The surgeon and his assistants are abundantly able to carry the burden and he is only wasting his time and actually getting in the way by thinking about it. Soon he will be all fixed up and back in his bed with a nice restful sedative.

So one might elaborate on ways and methods, on tone of voice and expression and gesture as one tides a patient over what is to him a trying and anxious time. If we are to operate on conscious patients, we must take due cognizance of the new element, namely, the conscious mind. It thus becomes a part of sound surgery, since it bears on the success of the operation, to apply what little we do know of the laws of human, and inhuman, behavior.

Much concern was caused by the severe reactions which sometimes followed the intradural administration of drugs of the cocaine group. An alarming fall in blood pressure presaged shock, unconsciousness and sometimes death. Such complications are now less severe and less common. I am convinced that in many of these cases the fault lay not primarily with the drug but with instability of the vasomotor system. That the reaction of the circulatory distribution and blood pressure to psychic stimuli varies widely in different individuals is a matter of common observation. This reaction is counteracted, more or less successfully, with adrenaline or ephedrine in relatively fixed dosage. As more is learned about blood pressure and the causes of these variations in the efficacy of its control, we shall be better able to suit the dose to the individual requirement. The nausea and vomiting are assumed to be related phenomena. I control these by posture, especially by lowering the head.

The lamest argument against spinal anesthesia is that one is committed to a procedure from which one cannot withdraw. The anesthetists are only coming face to face with a problem which confronts the physician and the surgeon daily and which, after all, is one of the commonest problems in life generally.

All in all, the more I see of spinal anesthesia, and the more I weigh it in my mind, the more convinced I am that it has a wide use in orthopedic surgery, in spite of its necessary limitations. It has passed the experimental stage and awaits only that perfecting, which advancing knowledge brings to all branches of medicine.

SPINAL ANESTHESIA
IN KIDNEY AND URETERAL OPERATIONS*

HOWARD S. JECK, M.D., F.A.C.S.

NEW YORK

BEGINNING with the year 1920 and up to the present time we have used spinal anesthesia in upwards of 600 cases on the Bellevue Urological Service. The great majority of these anesthetics have been administered for perineal or scrotal operations of one type or another, comparatively few for abdominal operations below the umbilicus, such as suprapubic prostatectomies and bladder operations and, until recently, none at all for kidney or upper ureter surgery. Prior to 1920, because of one or two unfortunate experiences attributed to it, spinal anesthesia was discontinued at Bellevue Hospital for a period of several years. After its resumption we proceeded with its employment a little timidly, perhaps more timidly than our results justified. At any rate, it was not until two years ago that we began to perform suprapubic prostatectomies or excise bladder tumors under spinal anesthesia, and today it is the exception to do them in any other way.

About eighteen months ago, encouraged by the reports of others,[1] we tried two or three nephrectomies under spinal anesthesia. The operations went smoothly enough until the kidney pedicle was pulled upon, when a general anesthetic had to be given. In each instance the spinal anesthetic was only partially successful. Somewhat discouraged by these results we rather lost interest in the employment of spinal anesthesia for operations above the umbilicus. The writer, for one, began to believe that the reports from various clinics of nephrectomies successfully performed were possibly exaggerated. But shortly after this

time, the writer happened to come in contact with Dr. Simon D. Ehrlich, visiting anesthetist to St. Mark's Hospital. He had done a great deal of spinal work. His accounts of high spinal anesthesias were so convincing that I decided to try one of his anesthesias on my next patient requiring a nephrectomy. He gave the anesthetic and the result was a success. In the course of the next two months, I had an opportunity to do a few more nephrectomies. Spinal anesthesia was employed in these cases, also with success.

We then began to wonder why our attempts at nephrectomy under spinal anesthesia at Bellevue were unsuccessful. There seemed to be two reasons: (1) The largest dose of novocaine employed was 100 mg. and (2) the injections had been made usually between the 1st and 2nd lumbar or 2nd and 3rd lumbar vertebrae. No injection had been given higher than the 1st lumbar interspace.

Since all our spinal anesthesias are given either by our regular urological visiting staff or the house staff and almost entirely by the latter, we requested Dr. Ehrlich to demonstrate his method before our house staff. The patient selected had a tuberculous kidney and required a nephrectomy. She was a Pole, very nervous, terribly afraid of being hurt and could neither speak nor understand English. She was almost the worst type of patient for this kind of demonstration. But the anesthetist rose to the occasion, employing 200 mg. of novocaine in the form of Pitkin's solution. The anesthesia was apparently perfectly successful, the kidney being removed without causing the patient any pain that we could detect.

Since this nephrectomy, which was the

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[1] CAMPBELL, M. F. Spinal anesthesia: a study of its use in 536 cases. *Anesth. & Analg.*, 6: 75, 1927.

PITKIN, G. P. Controllable spinal anesthesia. *J. M. Soc. New Jersey*, 24: 425, 1927.

first on our Urological Service in which a spinal anesthetic really worked successfully, we have employed Pitkin's solution in all

Left   Right

Fig. 1. Roentgenogram of patient with large branching calculus in right kidney pelvis. Urogram of left side. No injection into right kidney pelvis or ureter. Stone removed under spinal anesthesia.

our spinal anesthesias for kidney and upper ureter surgery as well as in those cases requiring low anesthesias. This preparation, as many of you know, consists of novocaine, starch paste, alcohol, strychnine sulphate and normal saline. The alcohol reduces the specific gravity of the solution permitting the anesthetic to float on the spinal fluid while the starch paste renders the solution more viscid than spinal fluid and thereby, theoretically at least, prevents rapid dissemination. The

strychnine is added for its direct stimulating action on the vasomotor centers.

TECHNIQUE

An important feature of Pitkin's technique in spinal anesthesia is the anesthetization of the skin and subcutaneous tissues at the site of the lumbar puncture with a 1 per cent solution of novocaine containing 0.05 gm. of ephedrine. This is a sufficient amount of ephedrine to prevent the rapid drop in blood pressure which usually occurs after the injection of novocaine into the spinal canal.

The complete technique employed in the case mentioned and also in the subsequent cases where a high anesthesia was desired is as follows:

Morphine $\frac{1}{4}$ grain and hyoscine $\frac{1}{200}$ grain are given one hour before the time set for the operation. The patient is placed on the operating table on the right side. At the site of the spinal tap, preferably in the space between the 1st and 2nd lumbar vertebrae, a solution of novocaine and ephedrine are injected into the skin and subcutaneous tissues. Lumbar puncture is then performed in the usual way but with a needle having a short point and no larger than a 22 gauge. (The larger needles cut too big a hole in the dura and encourage the escape of spinal fluid after the needle is withdrawn.) About 30 drops of spinal fluid are allowed to escape, to make room, so to speak, for an equivalent amount of Pitkin's solution which is then injected very slowly. Two c.c. of spinal fluid are then slowly aspirated back into the syringe and just as slowly reinjected (barbotage). The needle is withdrawn and the site of injection sponged off with alcohol. The head of the table is then immediately lowered. If the area of anesthesia is not sufficiently high the head of the table is then raised by degrees, for, according to Pitkin's theory, the anesthetic floats on the spinal fluid and is not rapidly disseminated. Thus the height of the anesthesia may be governed by the angle which the recumbent patient makes with the horizontal.

BLOOD-PRESSURE REACTION

The behavior of the blood pressure during an operation under spinal anesthesia,

CHART I. Systolic (s) and diastolic (d) blood pressure in a nephrectomy for tuberculosis of the kidney. Two hundred mg. of novocaine (Pitkin's solution) given between 12th dorsal and 1st lumbar vertebrae. Perfect anesthesia throughout.

especially a high spinal, is interesting. Just how much the blood pressure is influenced by the anesthetic itself and how much by the operative procedure it is difficult to estimate. In most cases both factors play a part. Certainly in kidney operations where it becomes necessary to pull upon the kidney pedicle, the blood pressure drops to a certain extent. Usually the fall in systolic pressure is 10 to 20 points, but exceptionally it may drop 40 points or even more. The pulse seems to be uninfluenced by the drop in blood pressure. In fact, in several cases it has been noted that when the blood pressure was at its lowest level, the pulse more nearly approached the normal.

Charts I and II illustrate the blood-pressure curves in average cases. In the majority of instances there will be an immediate drop in the systolic pressure of 20 to 30 mm. of mercury (Chart I). In a few cases there will be an actual immediate rise in the systolic pressure as shown in Chart II. This is doubtless due to the stimulating effect of the preliminary injection of ephedrine which also plays an

important part in other cases where there is no greater drop in systolic pressure than 30 points.
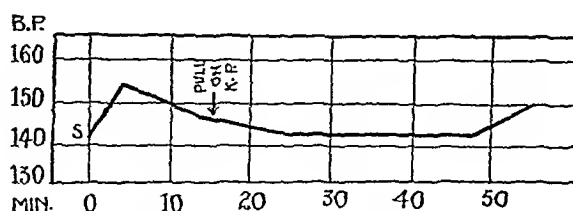
CHART II. Systolic pressure in a nephrectomy for tuberculosis of the kidney. Two hundred mg. of novocaine (Pitkin's solution) given between 12th dorsal and 1st lumbar vertebrae. Perfect anesthesia throughout. s indicates systolic pressure before anesthesia was given.

While a sudden fall in blood pressure is frequently alarming to the novice who gives spinal anesthesia, experience has shown that it is by no means indicative of the patient's actual condition during operation. Unless symptoms such as sudden pallor, rapid respiration or vomiting supervene, there is no occasion for alarm. Under such circumstances the giving of 0.05 gm. of ephedrine by hypodermic injection and further dropping the head of the table will usually suffice to alleviate the distress on the part of the patient.

SUMMARY OF CASES

Inasmuch as we resumed high spinal anesthesia on the Bellevue Urological Service only three months ago, our series of kidney and upper ureter operations is small.* To date we have done 10 such operations, a summary of which is as follows:

Nephrectomies	3
Pyelotomies	1
Ureterotomies for stone (high)	3
Ureterotomies for stone (low)	3
	10

In 8 of the 10 operations the anesthesia worked successfully, that is, the patients experienced no pain and no supplementary general anesthesia was given.

* Elsewhere I have performed a comparatively large number of nephrectomies under spinal anesthesia. These cases will be reported later.

Of the cases successfully done, attention should be directed especially to one in which pyelotomy was performed. The kidney contained a large branching calculus. This was removed through an incision into the parenchyma as well as the pelvis. The patient's postoperative temperature did not go above 100°F. and he was out of bed in less than two weeks. Prior to operation the right kidney, the one which contained the stone, showed a functioning capacity, according to the indigo carmine and urea tests, about half as good as the left kidney. Three weeks after the operation, according to the same tests, the function of the right kidney was about equal to that of the left. Ureteral specimens from both kidneys showed a few pus cells and staphylococci.

In the 3 high ureterotomies, the oblique loin incision below the last rib was employed. In the lower ureter operations, Gibson's incision was the one of choice.

Of the 2 operations in which the anesthesia was not successful throughout, one was a nephrectomy and the other a low ureterotomy. In the former the operator had to deal with a very large kidney and a very short pedicle. There were many dense adhesions. The anesthesia worked well for forty-five minutes and then it became necessary to finish the operation under general anesthesia. The ureterotomy operation was a secondary one for a small stone near the bladder. There were many adhesions. The anesthesia worked perfectly for an hour which is ample time ordinarily for such a procedure.

It is interesting to note that only 1 of the 10 patients reported suffered from postoperative abdominal distension. But even in this case it was not the troublesome type of ileus which so frequently follows kidney and high ureter operations performed under general anesthesias.

Our idea in reporting such a small number of cases at this time is simply to call attention again to the fact that high spinal anesthesia is a practical procedure. It seems to be especially indicated in urological surgery where so much depends on conserving the kidney function. Kidney operations, particularly nephrectomies, at times difficult under general anesthesia, are rendered comparatively easy when performed under spinal anesthesia by virtue of the complete relaxation obtained. There are no violent respiratory movements which so frequently embarrass the operator. In nephrectomy for the average tuberculous kidney, the advantage of spinal anesthesia becomes at once apparent.

Several years ago in a report of an operation performed under parasacral anesthesia, the writer inadvertently used the expression, "the anesthesia was a howling success." In designating certain of the anesthesias in the foregoing as successful, I do not mean they were judged by this standard. There were no howls.

LUMBAR ANESTHESIA

REMARKS BASED ON 1100 CASES*

James T. Case, m.d., f.a.c.s.

BATTLE CREEK, MICHIGAN

A GREAT deal of prejudice still exists against the employment of spinal anesthesia. Perhaps the very name "spinal" anesthesia has much to do with this prejudice. Most physicians personally experience some reluctance to undergoing spinal puncture and they seem to feel that they must protect their patients from any procedure which involves putting a foreign substance into the spinal canal.

Introduced by Corning in 1885, and popularized for a time by Bier in Germany and Tuffier in France, spinal anesthesia soon fell into disrepute because of incomplete successes and untoward effects resulting from the use of cocaine as the anesthetic agent. Revival of interest in the method followed the introduction of stovaine and novocaine in the year 1904, but this interest lagged until the Great War brought the need for renewed interest and wide adoption of this form of analgesia. Up to 1914 spinal anesthesia was reserved for special and limited cases. Coincident with the war there appeared several French preparations, notably French novocaine, which gave greatly improved results..

The literature abounds with reports of large series of operations under spinal anesthesia. I will mention only a few: Yount, 7000 cases; Duvergey, 1600; Moriel 2876; Riche, 3000; Babcock and associates, 17,000; Guibal, 3500; Coleman, 7500; Negley, 5500; Juvara, 11,000. My own experience during the last eight years includes over 1100 cases.

It will be observed that the title of my presentation is "lumbar" anesthesia. It is easy to stir up prejudice against a method which is unfamiliar. To avoid this I have adopted the term "lumbar" rather than "spinal" in describing this form of

nerve block. I once had a case referred to me by a physician for immediate surgical operation in emergency. The case was eminently suited to the type of anesthesia under discussion, and I had the patient's permission to go ahead with it; but just then the physician arrived to witness the operation. The physician asked: "Doctor, what kind of anesthetic are you going to use with this patient?" And, without allowing me time for reply, the further demand was made: "You are not going to use that spinal anesthesia, are you?" I replied: "Well, I was planning to use a low lumbar anesthesia." "Oh, that will be all right, then," came the answer. From that little experience, I learned the lesson, and every one of my associates in the hospital is requested not to use the term "spinal" in referring to anesthesia or diagnostic puncture, but rather the word "lumbar." It is strictly correct, and does not suggest something to be feared as does the word "spinal." I recommend the adoption of this terminology.

I never practice high spinal anesthesia though I have performed a considerable number of upper abdominal operations under this form of analgesia. The spinal cord ends at the second lumbar interspace, or just above it, and I rarely find it necessary to inject at a point as high as this. Most of the punctures are made in the third or fourth interspace.

A tray is prepared on which are laid out in the following order the necessary instruments: (1) A hypodermic syringe with very fine needle, charged with one-half of 1 per cent novocaine for anesthetizing the skin at the site of the proposed puncture. With this hypodermic I not only raise a good-sized wheal in the skin but

instill novocaine freely in the tissues down to the bone. (2) A scalpel with a very sharp point with which to puncture the skin. (3) A very fine, spinal puncture needle with obturator in place. The needle is preferably of some unbreakable, non-rustable material and about No. 22 gauge. The finer needles do not permit the escape of fluid after the withdrawal of the needle. It is better to have a needle with a short bevel. (4) A 10 c.c. hypodermic syringe, empty. (5) A third hypodermic glass syringe, also of 10 c.c. capacity, fitted with a small-caliber needle, through which the contents of an ampule of French "Scurocaine" have been drawn into the syringe.

The patient is usually seated, though occasionally there are cases in which the lateral position is better on account of weakness, giddiness or recent operation making the sitting position inadvisable.

The site of proposed puncture having been chosen and carefully sterilized by the means preferred, a wheal is raised at the point of election for puncture and the skin and soft tissues down to the bones are well anesthetized with the half of 1 per cent novocaine. A minute puncture is then made in the skin, exactly in the midline, and through this very small opening the spinal puncture needle is entered, with the obturator in place. After carefully inserting the needle almost to the point of entering the canal, the obturator is withdrawn, so that the escape of fluid will be noted at the very moment of penetrating the subarachnoid space. This result will be felt, perhaps even heard by carefully listening, as the needle is further introduced, following which fluid will, of course, begin to flow. I formerly measured the pressure of the spinal fluid, but after considerable experience, since this proved never to be of any particular help, I simply noted the force with which the fluid escaped through the needle. In the presence of evident high intraspinal pressure one may withdraw more spinal fluid before injecting French novocaine, he may inject a larger dose of the drug, and he may introduce it with much more force than is possible with abnormally low intraspinal pressures.

It is of the highest importance to enter the spinal canal with as little traumatism as possible. There is a markedly increased tendency to headache and backache from bungling efforts to penetrate the subarachnoid space, due not only to the multiple punctures of the membranes but also to the fact that with several puncture holes there is more likelihood of escape of fluid with resultant low intraspinal pressure, and subsequent headache and backache. There is also the probability of damaging nerve tissues if one is guilty of other than a minimum of traumatism.

It has become my practice to withdraw only 3 or 4 c.c. of fluid before detaching the second syringe and connecting to the spinal puncture needle the third one containing the French novocaine. A further quantity of fluid is withdrawn into the syringe containing the French novocaine until it has been diluted from 3 c.c. original solution to 5 or 6 c.c. or 8 to 10 c.c. according to the height and duration of the anesthesia desired. Without further ado, the diluted mixture is gently pushed into the subarachnoid space until the desired amount has been introduced. The needle is then withdrawn at once, a bit of adhesive placed over the puncture in the skin, and after a continuation of one-half to one minute in the sitting position, the patient is placed supine, with the head slightly raised by supporting it sharply bent with the chin on the chest. This position of the head is assumed at once if the operation is upon the lower extremities or the perineum or bladder; after a couple of minutes if the incision is to be placed wholly below the umbilicus; but after a still longer time if a higher incision is desired. Anesthesia is usually secured at once so that by the time the patient and the surgeon and his assistants are dressed sterile, the operation may commence.

As a matter of routine, while the patient is still sitting up, just after injecting the French novocaine, an ampule containing 1 c.c. of ephedrine is injected subcutaneously. Since taking this precaution, we

very rarely observe any notable lowering of blood pressure; on the contrary there is sometimes an actual elevation of the vascular tension. Formerly we employed caffeine as a preliminary medicament, and one to be used every ten or fifteen minutes during the progress of the operation; but since introducing the use of ephedrine about two years ago, we seldom find use for caffeine. The dose of ephedrine may be repeated *once* if there is indication for it.

The amount of anesthetic agent to be introduced is carefully estimated. The full content of the ampule is 15 cg. of French novocaine in sufficient normal salt solution to make 3 c.c. of 5 per cent solution. Thus the syringe when handed to me contains 13 or 14 cg. of French novocaine, allowing for leakage in transferring from ampule to syringe. By carefully noting the markings on the syringe, it is easy to estimate in centigrams the amount of French novocaine which enters the canal. For operations on the perineum of about thirty minutes' duration 8 cg. will suffice. For multiple operations where anesthesia of a full hour is needed I employ 10 to 12 cg. For unilateral hernia or appendix operation, 8 cg. will suffice but introduced at a higher level; for a double hernia or for a pelvic laparotomy (hysterectomy, for example) it is better to use the full dose of 12 cg. I term this the full dose, for I never inject more than this amount.

The level of the lumbar spine at which the injection is made has a bearing on the height and length of anesthesia. Formerly I injected always in the third or fourth interspace, varying the amount of fluid withdrawn and the force with which the French novocaine was injected. However, as my experience has increased, I have come to use much care to inject gently, and to secure the higher levels of analgesia by making higher punctures, even as high as the first lumbar interspace. This suffices for any operation below the diaphragm and for operations higher than that I consider this form of subarachnoid injection not indicated.

The lower the intraspinal pressure, the higher and the more rapid the diffusion of the anesthetic mixture; on the contrary, the higher the pressure, the larger the quantity of the drug and the greater the force which may be employed in introducing it. Hence, if one notes a very low intraspinal pressure, it may be wise to inject a reduced quantity, say even half of the estimated dose; and no time should be lost in bending the head sharply on the chest, as though the patient were trying to dig his chin into it.

By the maneuvers suggested, I have performed a considerable number of upper abdominal operations, including gastroenterostomy, partial gastrectomy, cholecystectomy, cholecystenterostomy, gastrostomy, resections of colonic tumors, epigastric herniotomy, in addition to all types of subumbilical surgery. I must in frankness add that the only cases which have given me any anxiety in regard to difficulty in breathing have been gall bladder cases. These will be referred to a little later.

The anesthesia lasts for from forty-five to sixty-five minutes on an average. I can recall no case in which it was of shorter duration and I remember very well one case in which I was able to complete a difficult combined abdominal and posterior resection for carcinoma of the rectosigmoid requiring a little less than two hours before the pain sensibility returned. When the pain sense begins to return before the termination of the operation it is a very simple matter to give the patient a little nitrous oxide-gas inhalation or ethylene-gas, a very little of which suffices to relieve the pain. If the operation is a prolonged one, I have no hesitancy in employing whatever degree of inhalation anesthesia may be required to complete satisfactorily the surgical work, so that I have a combined anesthesia, lumbar for the first fifty or sixty minutes, plus whatever duration of inhalation anesthesia may be necessary. It is remarkable that when the inhalation method is thus made to follow the lumbar injection, less of the inhalant mixture is required.

The question of mental trauma must also be considered. Naturally we do not choose this method of lumbar anesthesia for high-strung, nervous and apprehensive patients, unless we calm them by preliminary medication with *pantopon* and *scopolamine*. When this for any reason fails, or we have misjudged the psychic reaction of the patient, I never hesitate to proceed at once with general inhalation anesthesia.

In laparotomies I also find it very useful to employ a bit of psychotherapy along with the lumbar injection. It is not difficult to imagine the alarm which must be experienced by most patients realizing that a surgeon is about to cut into and through the abdominal wall, and many of our patients know, or think they know, so much about their anatomical structure that they easily let their imagination get away with them. So, in cases where I have not deemed it wise to give the preliminary narcotic or where it has failed to produce the desired amount of neglect of surroundings, I have my anesthetist give the patient pure oxygen with the anesthetic apparatus, so that he is fully occupied and is left no opportunity to speculate on just what the surgeon may be doing. Under these circumstances no talking is permitted except my occasional query as to how the patient feels, for the more quiet in the operating room, the more satisfactory are both the anesthesia and the operation. On the other hand, when the patient seems to desire to talk, I permit the anesthetist to carry on as lively a conversation as the case may seem to permit; so that a bystander once remarked that it was an excellent illustration of "hot air" anesthesia. Whatever may be the device resorted to, I believe it is important to relieve the patient of any possibility of mental trauma from a quietly borne but very poignant realization that the abdominal cavity is being opened. In perineal operations, or in hernia operations I very rarely have to give this matter any thought.

In the opened abdomen, the "abdominal silence" is a joy to the surgeon. The intestines, which are more contracted than we find them with general anesthesia, lie quietly without protrusion. Very often it is possible (and desirable) to work without retractors and with a slight lowering of the head of the table the intestines usually slip out of sight into the upper abdomen without the necessity of packing them back with napkins. The possibility of working with a minimum of traumatism to wound edges and abdominal contents permits a celerity of operation quite consistent with careful and satisfactory as well as satisfying work.

The convalescence of patients operated upon under such circumstances is strikingly free from complications. I hope to publish an account of a comparison of similar cases which will illustrate this point better than I can tell it in my own words. Enough to say that the nurses in the wards of our surgical service find it much less strenuous to care for a patient with a serious abdominal operation done under lumbar anesthesia than for a similar case with the operation done under inhalation anesthesia.

The discussion of this topic might be prolonged for several pages, in order to take up in detail the sequence of events which follow the lumbar introduction of novocaine: the various factors concerning diffusion of the drug; methods of overcoming difficulties in entering the theca; the effects on respiration; blood pressure; the factors concerned in the blood pressure manifestations; the relation of secondary shock following operation to spinal anesthesia; the control of retching and vomiting which occasionally occur during anesthesia; the question of postoperative headaches, which occur very rarely with us; the occurrence of postoperative pneumonia, albuminuria and nerve complications,— all of which are conspicuous in our experience by their scarcity or complete absence. There are a number of little devices of technique which make it possible to control with a high degree of accuracy not only the height and duration of the anesthesia resulting from the lumbar injection of novocaine, but also the occurrence of the unpleasant little complications which may

sometimes arise, and which have been greatly magnified by opponents of this highly useful form of nerve block.

Permit me to mention the outstanding complications which constitute all of that type occurring in our experience with more than 1100 lumbar anesthesias in the last eight years. No deaths have occurred in this series which could by any stretch of the imagination be attributed to the method of anesthesia. There were 3 cases of suspension of respiration, all curiously enough occurring with gall bladder operations. In 2 of them the apnea occurred at the moment of clamping the cystic duct although no traction was being made; in the third, a case of hemorrhagic pancreatitis, respiratory collapse occurred at the moment of incising the peritoneum. In the first 2 cases a few minutes of artificial respiration with the aid of the oxygen tank of the anesthetic apparatus sufficed to restore tranquillity and the operations were terminated without further or subsequent anxiety. In the hemorrhagic pancreatitis case, it was necessary to suspend the operation, doing a simple drainage of the peritoneal cavity which was full of blood-stained bilious fluid containing abundant evidence of fat necrosis, after which the patient's respiration was restored, but she succumbed the following day. We now know that such a case is not suitable for lumbar anesthesia, for the patient was in a state of shock with lowered blood pressure before she reached the operating table.

The only case of nerve damage of which we have knowledge in our series is described in the following report by my colleague, J. M. Nielsen:

Mrs. I. T., aged thirty-six, was submitted to operation for perineoplasty, which was done under lumbar anesthesia. When this began to wear off the patient complained of severe pain in the tip of the coccyx and in the sacral region. This continued unabated for two weeks and was relieved temporarily by heat but not in any other way except by opiates. With the pain came a saddle-shaped area of total anesthesia in the perineum and buttocks, and rectal and vesical insensibility, and the patient became involuntary and incontinent.

When seen two weeks after operation the foregoing was confirmed but there was in addition hypesthesia in the first sacral and second sacral areas on the left and all lumbar segments on the right. The lumbar segments escaped on the left, while the first and second sacral segments escaped on the right. The pain was greatly increased by raising the trunk, straining, coughing or sneezing. A diagnosis of a cauda equina lesion was made—probably hemorrhagic. Improvement has been steady but slow. At this writing, five weeks from the onset, there is marked sensitiveness in the area formerly totally anesthetic. The other segments have returned to function but the patient walks clumsily.

The final healing in this case was complete and there is at present no complaint whatever, or any objective sign of nerve disturbance.

In closing permit me to express my enthusiasm for this form of anesthesia for patients in adult life. I have not had much occasion even to consider it for children, but I think it would be difficult for me to administer it to a child. It is not suitable for patients suffering from vascular depression of marked grade, and I seldom employ it when the systolic blood pressure is below 100. Myocardial degeneration with decompensation, pericardial or pleural effusions and recent untreated syphilis are considered as absolute contraindications. Otherwise this form of analgesia is admirably suited to practically every kind of operation below the umbilicus. I think it should be an anesthetic of selection only in certain cases above the umbilicus. I never employ it for supradiaphragmatic operations. Were it not for the still widespread prejudice against the method, I would use it much more extensively than I do. I have never had any experience to discourage me from this stand. We still have patients who ask why they cannot go to sleep so they will not know anything about the operation. I believe the day is not far distant when on proposing a general anesthetic the question will be just the opposite, "Doctor, why must I go to sleep for this operation?"

CONTROLLABLE SPINAL ANESTHESIA

THE USE OF PITKIN'S METHOD IN ONE HUNDRED CASES*

Joseph L. DeCourcy, m.d.

CINCINNATI

ALTHOUGH spinal anesthesia has been employed sporadically since 1885, when it was first described by Corning,[1] most surgeons have hesitated to use it on a large scale because of the alarming fall of blood pressure and the considerable number of fatalities that have been reported in the literature. Up until a short time ago I was among those who resorted to spinal anesthesia only when a general anesthetic was contraindicated. Formerly I limited its use largely to tuberculous, diabetic and senile patients and prostatectomies.

Steel[2] in 1925 pointed out that a fall of blood pressure is constant during spinal anesthesia, that it is the one possible danger, but that it may cause death. Usually the low point of the blood pressure occurs about ten minutes after the injection and this is the time when most of the fatalities have occurred. Before the advent of ephedrine, epinephrine intravenously was the only remedy at our disposal to correct blood pressure collapse; but, as a prophylactic measure to maintain blood pressure during spinal anesthesia, Steel found ten minutes of ether inhalation very efficacious.

In general, recent statistics before the advent of Pitkin's method give a mortality of about 1 per 1000 for spinal anesthesia, except in those series in which it is apparent that the greatest precautions were not taken, in which the mortality was much higher. Martin and Arbuthnot[3] in 1926 reported a series of 6000 spinal anesthesias with 6 deaths. Their extensive experience convinced them that under spinal anesthesia: "The fall in blood pressure is greater than with any other anesthetic; hence, spinal anesthesia should not be used in patients with great circulatory hypotension or in those with myocardial degeneration or anemia." They believe that spinal anesthesia is most valuable and efficient for operations below the diaphragm when complete muscular relaxation is sought. For prostatectomy they have found it much preferable to ether anesthesia. "Even if it [the mortality] were 1 in 100," they write, "it would still be a desirable anesthetic in selected cases because the postoperative mortality directly attributable to inhalation anesthesia in many prostatics is considerably greater."

Before the work of Pitkin, an objection to spinal anesthesia was the difficulty of preventing rapid diffusion of the anesthetic solution in the spinal fluid. This diffusion made it almost impossible to control the anesthesia and occasionally resulted in death when the anesthetizing solution caused blood pressure collapse or reached the medulla oblongata.

PITKIN'S METHOD OF CONTROLLABLE SPINAL ANESTHESIA

I regard the report of Pitkin's work[4] as of epochal importance in the history of spinal anesthesia. It will undoubtedly move many surgeons who have previously been deterred by the alarming fall of blood pressure and an occasional fatality to adopt spinal anesthesia almost as a routine for operations below the diaphragm, as I have done.

The introduction of spinocain, a viscous solution of novocaine and strychnine having a lower specific gravity than that of the spinal fluid, has enabled us to prevent diffusion of the anesthetizing solution in the subarachnoid space and also minimize the fall of blood pressure. The formula of Pitkin's solution, or spinocain, is as follows:

	Gm.
Novocaine	0.195
Strychnine sulphate	0.0022
Starch paste	0.13
Alcohol	0.324
Normal saline q. s. ad	2.00

Encouraged by Pitkin's report of successful spinal anesthesia in a large number of cases, I employed his method in a series of 100 operations. My series included 12 cholecystectomies, in some of which there was a stone in the common duct; 5 gastroenterostomies, 3 for duodenal and 2 for gastric ulcer; 4 nephrectomies; 3 prostatectomies; 2 leg amputations; also a number of hysterectomies, perineorrhaphies and operations for cancer of the rectum. During this period all of my appendectomies, both for acute and chronic conditions, were performed under spinal anesthesia.

My results have been so encouraging that I am now using spinal anesthesia as a routine for all operations below the diaphragm; but, before analyzing the results, it may be well to discuss the technique of Pitkin's method as we have employed it at the clinic.

TECHNIQUE OF THE INJECTION

Spinocain differs from most spinal anesthetics in that its specific gravity is much lighter than that of the spinal fluid. Consequently, if it is injected with the patient in the sitting position, it will rapidly ascend in the spinal canal so as to anesthetize the upper portion of the cord. For this reason, it is preferable to inject the spinocain with the patient lying on his side. Or, if the injection is made while he is sitting up, he must lie down immediately afterward.

If an appendectomy or cholecystectomy is to be performed, the patient should lie on his left side. When this is done, the spinocain solution, being lighter than the spinal fluid, floats on the top so as to anesthetize the right spinal roots. For a left-sided operation, the position should be reversed. If a median incision is to be made, the patient should lie on his back after the injection.

The spinal puncture itself can be made painless by preliminary local anesthesia over the site of the puncture. Using a needle of fine gauge, one injects one-half the contents of an ephedrine-novocaine ampule beneath the skin over the interspace. Then, without withdrawing the needle, he carries it directly toward the interspinous ligament, injecting the other half of the solution as the needle is pushed along. The spinal puncture needle is pushed through this anesthetized area, directly in the midline between the two spinous processes. Pitkin's lumbar puncture needle is of a No. 20 to No. 22 gauge with a 45° bevel. The use of ephedrine in the anesthetizing solution has the effect of raising the blood pressure and thus prevents one of the most dangerous complications of spinal anesthesia.

Originally I used 2 c.c. of Pitkin's solution as a routine. I soon discovered, however, that 1 c.c. is sufficient for low abdominal work and believe that the use of this lesser amount materially diminishes nausea. In my opinion, this symptom, like syncope, is due to splanchnic dilation resulting from use of an excessive quantity of the solution. Rough handling of the abdominal viscera, too, may play a part.

It is important not to allow an excess of spinal fluid to escape before making the injection; otherwise, the anesthetizing solution in the spinal canal will be unduly concentrated and will not have a sufficient volume of spinal fluid on which to float.

The perineal region is the first to be anesthetized, then the legs, the lower abdomen, upper abdomen and finally the margin of the ribs. When anesthesia disappears, it leaves in the reverse order. Thus anesthesia of the perineum is the

first to come and the last to go. The operation may be started ten minutes after this injection.

After the spinal puncture needle has been introduced into the canal, it should be connected in situ with a 2 c.c. Luer-Lok syringe containing 1 c.c. of spinocain. If perineal anesthesia alone is desired, several drops of the spinal fluid are withdrawn into the syringe, and then the entire contents is injected. Immediately the head of the table is lowered and the patient placed in a partial Trendelenburg position of 15 to 18 degrees. This degree of inclination can be measured accurately by a tilt-ometer, or inclinometer. To produce anesthesia in the lower extremities the inclination should be 10 to 15 degrees. I regard the immediate use of the Trendelenburg position as the most important measure to prevent nausea.

Should it be desired to bring the level of anesthesia above the umbilicus, 2 c.c. of spinocain must be used. One cubic centimeter of spinal fluid is drawn into the syringe containing 2 c.c. of spinocain, after which half the contents of the syringe is injected. Then another 1 c.c. of spinal fluid is drawn into the syringe, and half the contents is again injected. This procedure is repeated several times, until finally the entire contents is injected. The table is then placed in a 7 to 10° Trendelenburg position, as determined by the tiltometer.

To bring the level of anesthesia up to the costal margin, the procedure of aspirating and re-injecting should be repeated half a dozen times. The Trendelenburg position should be 5° as determined by the tiltometer. This method produces anesthesia as high as the level of the sixth or seventh dorsal vertebra.

By raising the head of the table, one can elevate the level of the anesthesia, since the spinocain solution floats upward; but the Trendelenburg position should be resumed immediately when the desired level of anesthesia has been obtained.

CONTROLLING BLOOD PRESSURE

Under all forms of spinal anesthesia, including that introduced by spinocain, the blood pressure must be watched. If it should fall below 80 mm., subcutaneous injection of 3 grains of caffein sodium benzoate should be employed. At the close of the operation, when the blood pressure is low, caffeine by rectum is useful.

Hitherto one of the chief objections to spinal anesthesia has been the danger of too great a fall in the blood pressure. This danger can now be prevented by the use of Pitkin's solution, because it is viscous and also contains strychnine; by preventing the diffusion of the anesthetizing solution within the spinal canal; and by administering ephedrine.

Probably the most valuable means of preventing serious lowering of the blood pressure following spinal anesthesia is by the administration of ephedrine. Ockerblad and Dillon[5] reported on this method in 1927 and found that: "although in fully 90 per cent of the spinal anesthesia patients there is a dangerous drop in both the systolic and the diastolic blood pressure, the judicious use of ephedrine successfully restores the right amount of arterial tension necessary for well being."

Ephedrine is an active alkaloidal principle derived from ma huang, which is indigenous in China and has been known in Chinese medicine for more than five thousand years. Both chemically and pharmacologically it is closely related to epinephrine. Like epinephrine it is a powerful stimulant of the sympathetic nervous system and raises blood pressure in this way. Ephedrine is effective on oral as well as subcutaneous administration.

Ockerblad and Dillon advise the administration of ephedrine subcutaneously when the blood pressure has fallen 10 per cent; then blood pressure readings should be made at ten minute intervals. They believe that 0.1 gm. of ephedrine should be injected before the blood pressure has been allowed to fall below 100 mm.

AVOIDABLE COMPLICATIONS

Postoperative headache is due to imperfect technique in the performance of spinal puncture, not to the anesthetic. The withdrawal of too large an amount of spinal fluid after ordinary spinal puncture is likely to cause headache by affecting the pressure of cerebrospinal fluid in and about the brain. Even when an excess of fluid is not withdrawn, the use of a large needle, or repeated punctures of the dura, may produce seepage and loss of fluid and thus cause headache.

Postanesthetic paralysis is a relic of the early days of spinal anesthesia, when large, clumsy spinal puncture needles were used. When used inexpertly, the large needles traumatized the spinal roots and frequently produced localized intradural hematoma, in this way causing paralysis. In skilled hands and with the small needles now used, paralyses do not occur.

In the past there were a number of fatalities from spinal anesthesia resulting from accidental anesthetization of the respiratory center. When spinocain is used, this accident cannot occur, provided that the patient is kept in the Trendelenburg position and anesthesia is not allowed to ascend above the level of the sixth or seventh dorsal vertebra.

The administration of morphine sulphate, grain 1/6, one hour and again one-half hour before operation helps greatly to quiet the patient's anxiety. He should be told frankly what to expect. During the course of the operation, all unnecessary conversation should be omitted, as it has a tendency to disturb the patient.

The injection should be given by one who is adept at doing spinal punctures, preferably an anesthetist who has had much experience in general anesthesia. His supervision during the operation is just as important as when general anesthesia is employed. Change of color or other alarming symptoms should, of course, be promptly reported to the operator. Complete asepsis in performing the spinal puncture and giving the injections is indispensable. At the clinic our anesthetist prepares the field prior to the spinal puncture as for a surgical operation. He wears gloves until the injection is completed. Then he removes his gloves and records the blood pressure continually until the operation is over. This is a safeguard of much importance.

RESULTS

My results with Pitkin's method of spinal anesthesia have been excellent. This procedure has the advantage that the anesthesia is at all times under control: Its intensity and duration can be regulated; any desired level of anesthesia can be reached by slightly modifying the technique; even right-sided or left-sided anesthesia can be produced, as desired. As compared with other forms of spinal anesthesia, Pitkin's method produces much less nausea and fall in blood pressure.

In my whole series I did not observe a single case in which there were alarming symptoms from the anesthetic. In about one-third of the cases nausea occurred while the patient was on the table, but it was transient and did not interfere seriously with the operation. Occasionally, it was necessary to suspend work for one or two minutes until retching ceased.

In operations upon the lower abdomen there was very little fall of blood pressure, so slight as to be of no importance. In the upper abdomen, there was a noticeable fall of blood pressure, especially when it became necessary to use traction on the stomach or intestines.

In operations upon the stomach and gall bladder, I found spinal anesthesia especially valuable, because efficient muscular relaxation and absence of straining facilitated better exposure of the operative field.

The postoperative condition of my patients was especially gratifying. There was surprising freedom from nausea, gas pains and other discomforts so common after general anesthesia.

Since ether undoubtedly contributes to

the mortality in prolonged operations under general anesthesia, I am convinced that the use of Pitkin's method will lower the mortality from abdominal operations. My limited experience has led me to adopt spinal anesthesia as a routine for all operations below the diaphragm.

CONCLUSIONS

1. Controllable spinal anesthesia by Pitkin's method, with spinocain as the anesthetic, is so safe and effective as to deserve first consideration for all operations below the diaphragm.

2. Fall of blood pressure under spinal anesthesia may be minimized by the use of spinocain, preceded by ephedrine and novocaine local infiltration and followed by the Trendelenburg position. It is best treated by injections of ephedrine or caffeine sodium benzoate.

3. By slightly modifying the technique, one may obtain any desired level of anesthesia.

4. Postoperative headache, nausea or paralysis may be avoided by proper technique.

5. In a series of 100 major operations performed at the DeCourcy Clinic under spinal anesthesia, Pitkin's method gave consistently excellent results.

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ELIMINATION OF DANGERS OF SPINAL ANESTHESIA*

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THE safety of spinal anesthesia is subject to a number of considerations, most important of which is the experience of the man who uses it. Experience implies not only skill in the accomplishment of the injection technique, but thorough familiarity with the general principles on which the method is based, clear conception of the nature of the mechanism which operates the various clinical pictures, and strict observance of the laws which govern the *mise en train* and safe operation of such mechanism.

Spinal anesthesia is defined as the method by which analgesia of part or whole of the body can be obtained by the injection of an anesthetic solution into the subarachnoid space. Maintenance of consciousness is one of its characteristic features.

There are four main procedures which have, at some time during the last forty odd years, been used. They are referred to in terms of the territories involved in or the levels reached by the anesthesia thereby produced. These procedures are: (1) *low analgesia,* which involves the pelvis and lower extremities; (2) *high analgesia,* which extends from the line of the nipples (occasionally the clavicles) to the toes, and is available for all operations below the diaphragm; (3) *segmental analgesia,* which covers only a segment of the body and is used particularly for operations on the thorax, upper extremities, neck or head; and (4) *general analgesia,* which involves the entire body and has been used rather extensively during the World War for the surgical treatment of multiple wounds scattered all over the body. Familiarity with the clinical aspects of each of these procedures is essential.

Puncture of the spine and injection can be and has been made at many levels between the third cervical vertebra and the sacrum, the selective sites being *mediocervical* for the head and neck; *cervicodorsal* for the upper extremities, breast and upper thoracic region; *dorsolumbar,* for the lower thoracic region, abdomen and the lower part of the body; *lumbar* for the pelvis and lower extremities; and *lumbosacral,* for the perineum, rectum, anus and distal segment of the lower extremities.

The territories anesthetized do not always bear a relationship to the level of the spine at which the injection is made; thus *general analgesia* may be produced by injecting in *any of the lumbar spaces* and also through the *lumbosacral hiatus.* The manner in which the injection is made is of major importance.

The higher the *puncture,* the greater the risk of injuring the cord and causing extensive functional disorders. The higher the *level of analgesia,* the greater the danger of severe complications which may result in respiratory failure. The higher the *segmental analgesia,* the greater the risk of upsetting the cardiovascular and respiratory balance, as a result of interference with the extrinsic mechanisms of circulation and respiration.

Reduction of intraspinal pressure by spoliation of cerebrospinal fluid should be well understood before it is practised. The greater the withdrawal, the more extensive the diffusion of the anesthetic fluid injected, and all things being equal, the greater the precautions to be taken. The higher the complexity of the technique employed the greater the risk of introducing adverse factors in the achievement of end results.

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625

It was unexpectedly that spinal analgesia came to light and its alleged simplicity of technique soon gave it wide popularity.

tory findings were possessed of sufficient clinical value!

In the attempt to prevent diffusion of
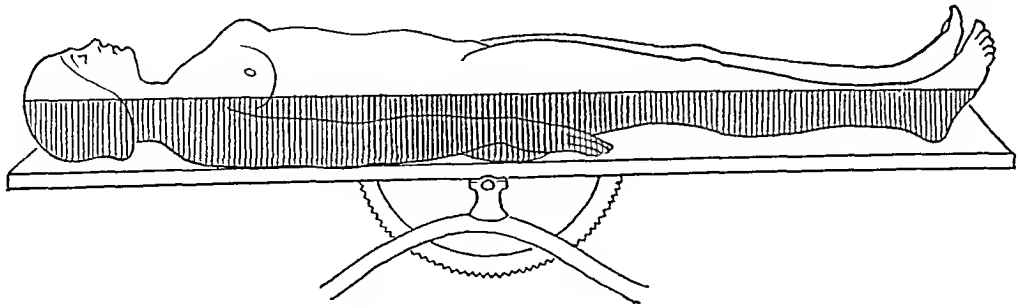
Fig. 1. Indifferent—caution. Dependent portions of body are richest in blood.

Bier, Barker, Tuffier, Babcock are names too well known to be introduced to the medical profession. Their pioneer work contains a wealth of information from which inference may be drawn that the clinical picture of spinal analgesia was not as bright as the injection technique was simple.

When cocaine was the only anesthetic drug available, disasters were attributed particularly to the high toxicity of its solutions. Spinal anesthesia was dropped by all except Tuffier in France, until a less toxic drug could be found. The discovery of tropacocaine renewed interest in spinal analgesia, but that of stovaine and novocaine gave the method greater impetus. It appeared, however, that many of the undesirable symptoms observed with cocaine and tropacocaine were also noted following the use of the new drugs. Respiratory failure was the most dreaded complication.

The prevailing opinion was that respiratory failure was due to the diffusion of the anesthetic solution to the medulla oblongata, thus reaching the center of respiration and blocking it off. This opinion was based partly on theory, but chiefly on laboratory findings following the use of artificial spines, such as glass tubes with rubber accessories. These were deemed analogous to the natural living spine for the purposes of experimentation, and it was generally conceded that such labora-

the drug to the higher centers the head was elevated until, in many instances, the patient had reached the sitting position. But this did not help, although the anesthesia was intended mostly for operations on the lower extremities and the lower part of the trunk. It had also occurred to some of the pioneers that the injection of an anesthetic solution heavier than cerebrospinal fluid would be safe for all operations that could be performed on the patient in the sitting posture, and that the use of a solution lighter than cerebrospinal fluid would be most desirable whenever the Trendelenburg position was one of the steps of the operative technique. Their laboratory findings seemed to have been conclusive.

The addition of one form or another of sugar, viz., glucose, dextrin (from starch), mannose (from manna), lactose (from milk), to the anesthetic fluid, in certain proportions produced a heavy specific gravity fluid; that of ethyl alcohol, a light specific gravity fluid. By means of these solutions it was expected to be able to prevent the gravitation or the diffusion of the solution to the brain by controlling its progression in the subarachnoid space. By holding the patient with the head and hips raised for a certain length of time the solution would stay at the most dependent portion of the spine until it had acted on the nerve roots at that level.

By sitting the patient the heavy fluid would drop into the dural cone and anesthetize the sacral nerves only. The in preventing the drop of the blood pressure or raising this pressure after it had fallen, since all were not agreed as to the
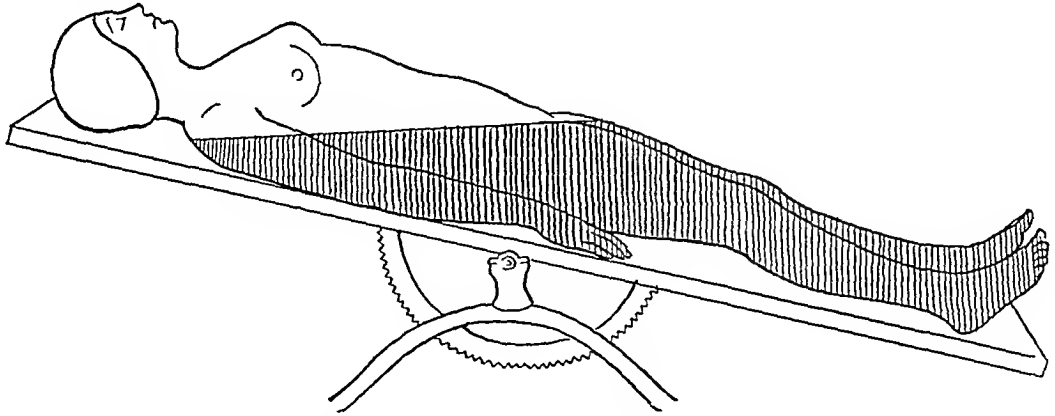
Fig. 2. Anemia of brain—death. Position favoring acute anemia of brain.

idea of "controllable spinal anesthesia" was thus born.

With the use of solutions of variable specific gravities, some of which were isotonic with the body fluids, the development of individual technique was strictly in accordance with the principles then prevalent that the injected fluid should not be allowed to reach the respiratory center. The clinical picture did not brighten and the complications were, at that time, almost similar to the ones noted before. The use of these solutions did not eliminate the dangers of respiratory failure.

Among the early symptoms associated with spinal anesthesia was a sudden drop in the blood pressure which occurred within three minutes following the injection and reached its lowest point ten minutes later. This was noted by all careful observers. It was at times very great, but seemed to be of secondary importance, since the danger of respiratory failure as the result of the diffusion of the drug to the brain overshadowed the gravity of circulatory disorders. The cardiovascular depression was thought to be one of the cardinal symptoms by which the toxicity of the drugs made itself manifest; it was treated as such with varying results.

The use of many drugs such as alcohol, atropine, strychnine, caffeine, pituitrine and adrenaline had apparently little effect

clinical value of any particular drug; nor could it be determined in what manner these drugs should be administered to the best advantage. Thus it is that they were given before, during or after the induction of anesthesia, in solution with the anesthetic drug, in simple solutions or in combinations, such as strychnine with caffeine. They were injected either subcutaneously, intravenously or intraspinally. Of course there are many reports of the benefits derived from the use of these cardiovascular stimulants, but these reports may have been influenced by considerations which are not alluded to in this paper. Failure to raise the blood pressure under these conditions was evidently the best proof that such a circulatory depression was not of the type that could be improved by the drugs at hand.

Spinal anesthesia gradually lost its popularity and was by many considered a dangerous procedure. The firm believers in this method, however, continued to use it with care and discrimination, while conducting their research in multiple directions.

About eight years ago, spinal anesthesia was again brought to the attention of the medical profession. With increased experience and a clearer conception of the nature of the mechanism which causes circulatory disturbances it has been possible to control these disturbances, and respira-

tory failure has become extremely rare; it has, in fact, not been observed by many experienced men for a number of years.

tory disturbances ranging from the classical embarrasment or "air-hunger" to the ever-dreaded respiratory failure.
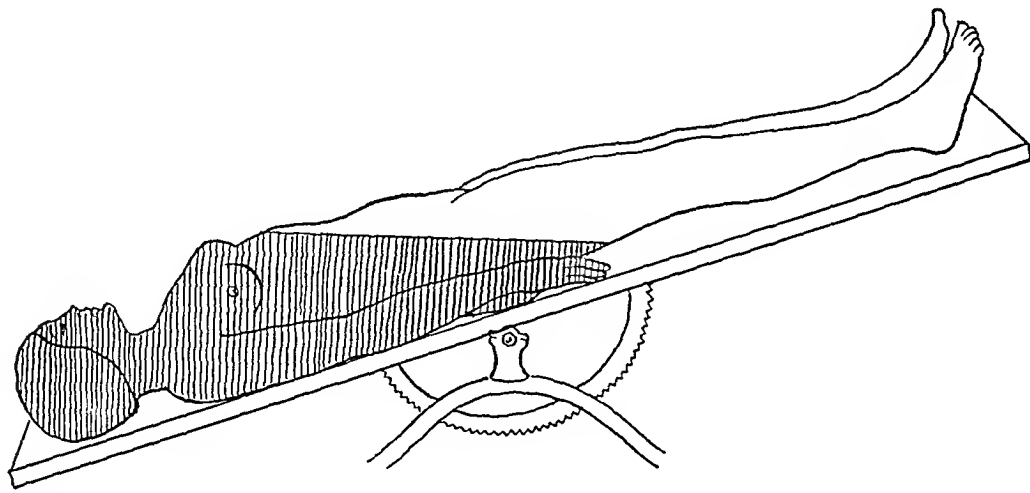
FIG. 3. Life. Trendelenburg position, rational position during subarachnoid block (spinal anesthesia).

When an anesthetic solution is injected into the subarachnoid space it soaks the nerve roots as they leave the cord and blocks both afferent and efferent paths. Impregnation of a certain thickness of the white substance of the cord may also ensue. Transmission of sensory and motor impulses is interrupted in the territories supplied by the nerves injected. The vasomotor fibers contained in the anterior roots of these nerves and destined to control the tonus of the blood vessels are also interfered with, thus paralyzing to a certain degree the musculature of the arteries particularly; the splanchnic vascular system is consequently relaxed in proportion to the number of nerves blocked in the subarachnoid space. If the diffusion of the anesthetic drug extends from the fifth thoracic to the third lumbar nerve, the abdominal blood vessels and their tributaries are enlarged and take more blood at the expense of the peripheral blood vessels. If the anesthesia involves also the second, third and fourth thoracic nerves, then the vascular system of the entire body is relaxed. The dependent portions become the richest in blood; the most elevated parts, the poorest. If the head is kept elevated the brain suffers from acute anemia which results in respira-

The blood vessels of the brain, besides being terminal, are not supported by muscles and aponeuroses, as in all the other regions of the body. Their lumen cannot be kept wide open, unless they are constantly fed by circulation. Lack of blood in these vessels results in complete collapse and may cause instant death by respiratory and cardiac failure; prolonged impoverishment in their blood supply induces a partial collapse which may carry the patient to death in a comatose or semi-conscious condition lasting from three to twenty-four hours. Thus is reduced to its simplest terms, we believe, the explanation of the nature of the mechanism which causes respiratory failure and death.

With this understanding, the Trendelenburg position is the only remedy. We cannot, with impunity, delay its use until the anesthetic drug has been fixed to the nerves at any desired level of the spine. It is dangerous to abstain from using it in certain cases, even though the anesthesia is not meant to reach the splanchnic nerves; even though the drop in the blood pressure is expected to be so slight as to be negligible. As a general rule, the Trendelenburg position should, besides, be maintained for three hours at least after the operation.

The literature is rich in statements to the effect that the Trendelenburg position retards respiratory failure. Why wait until

when the patient feels very weak, is slow in answering questions, or becomes unconscious.
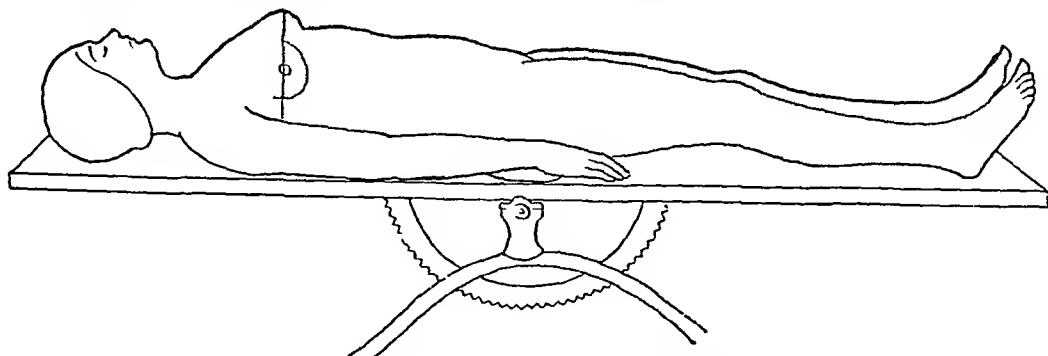
FIG. 4. Indifferent—caution. Extent of anesthesia in supine position, established by injection.

undesirable symptoms call for its use? All those who have used the Trendelenburg position since the early days of spinal anesthesia have reported good results; although the physiology of the method had not then been ascertained, nor its study approached from a favorable angle. With the use of the Trendelenburg position immediately following the injection, such symptoms as pallor of the face with cold sweats and respiratory embarrassment have almost completely disappeared from the picture; they are still present when the patient is unnecessarily kept in the recumbent posture and placed in the Trendelenburg position too late. They may also be observed when patients, particularly the aged and arteriosclerotics, are moved too rapidly from the Trendelenburg to the horizontal position, usually at the end of an operation of short duration, such as a second stage suprapubic prostatectomy. One of the dangers of spinal anesthesia lies in the lack of knowledge of the fundamental principles of the method and inability to protect such patients.

It has been repeatedly stated that some patients become pulseless on the operating table and that the blood pressure is so low, in certain instances, that no reading can be made. This is quite true and should cause no worry if the patient's condition is otherwise satisfactory; but it is a danger signal if it is accompanied by pallor of the face with cold sweats, particularly

The inability to make blood-pressure readings at the arm or feel a wrist pulse is indicative of the laxity of the vascular system and lack of adequate means to register the propagation of the waves at each systole. The peripheral resistance having been decreased by the blocking of the sympathetic system, it is not surprising that the energy of the heart beats is diminished and that the frequency of the pulse likewise modified. The heart having light work to perform takes a rest during spinal anesthesia. For this reason spinal anesthesia is the method of choice in all cardiovascular diseases.

No attempt should be made to control by posture the level of anesthesia. The injection of anesthetic solutions of variable specific gravities which are meant to preclude the use of the Trendelenburg position immediately following the injection has not given the results which they were expected to produce. Posture should serve as a cushion to soften the abruptness of circulatory depression.

The level of anesthesia is not disturbed by posture. Clinical experience proves that the extent of anesthesia varies chiefly with the pressure with which the injection is made and the extent to which the intraspinal pressure has been lowered before the injection. Thus it is that general analgesia is induced by withdrawal of large amounts (20 to 30 c.c.) of cerebrospinal fluid before injecting. LeFilliatre

makes the *barbotage*, Delmas the *injection brusquée*. Both aim at the same result, *viz.*, general analgesia. Jonnesco is very particular on the necessity of not withdrawing any fluid to obtain segmental analgesia. As far as the author's technique goes, the level of anesthesia was tested in 101 patients placed in the Trendelenburg position immediately after the injection, and in no case did the drug give evidence of having reached the upper extremities or a level higher than that attained before the lowering of the head. There may, however, be slight differences depending chiefly on the velocity of injection and the rapidity with which the Trendelenburg position is assumed; but they are not great enough to alter conditions, since they do not exceed 3 or 4 inches.

Chemical tests for novocaine in the lumbar region remain positive during the entire period of anesthesia while specimens of cerebrospinal fluid taken in the dorsal region, higher than the level of the anesthesia, are free from the drug or contain only very weak traces of it. The above findings tend to prove that the level of anesthesia is not controlled by posture.

The danger does not lie only in the extent of anesthesia, but in the unnecessary delay in the use of the Trendelenburg position or the loatheness to lower the head promptly because of the fear of the alleged diffusion or gravitation of the anesthetic fluid to the brain.

The contraindications to spinal anesthesia are based chiefly upon physiologic considerations. The vagus, motor or accelerator nerve of the gastrointestinal tract
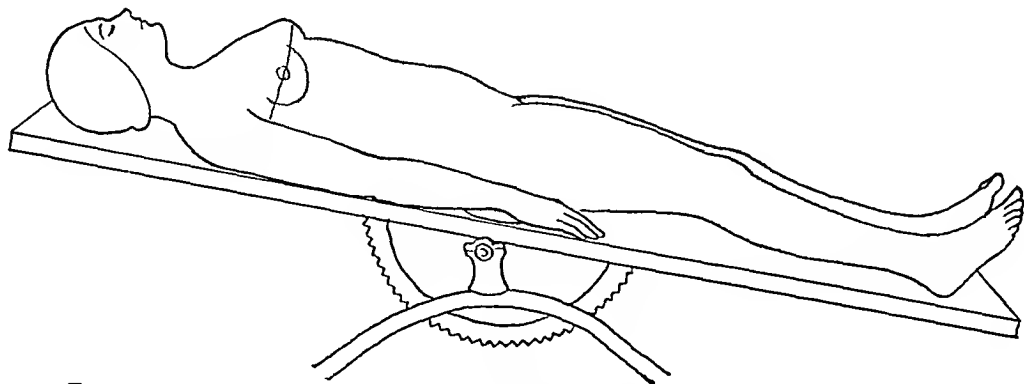
Fig. 5. Anemia of brain—death. Level of anesthesia not disturbed when head is raised.

being free to overexercise its function after the blocking of the sympathetic system, spinal anesthesia should not be used in gastrointestinal perforations, whether pathologic or traumatic, and localized peritonitis. In intestinal perforations, the contents of the bowels would be milked out as a result of contracted bowels and hyperperistalsis; for the same reason, localized peritonitis would be spread to the entire abdominal cavity following the destruction of protective adhesions. It is not a good procedure to be used in strangulated hernia or for the removal of a ruptured appendix. It is not recommended in syphilitic or epileptic patients, because the occasional coincidence of pathologic developments inherent to their disease might be attributed to the anesthesia. At the present stage of our knowledge it is impossible to say positively whether or not the injection of an anesthetic drug in the subarachnoid space would be a contributing factor in the occurrence of a paraplegia or psychosis. It is self-evident that local pathologic conditions of the spine contraindicate the use of subarachnoid block. Lumbar puncture is a dangerous procedure in patients with cerebellar tumors, *a fortiori*, spinal anesthesia.

In order to eliminate some of the dangerous features of spinal anesthesia the technique should be simple. In view of the

numerous reports that stock solutions have in the past been accused of bringing about many complications, all solutions should

parts of the body has, in the hands of its pioneer advocates, occasionally been followed by disastrous results. We have used
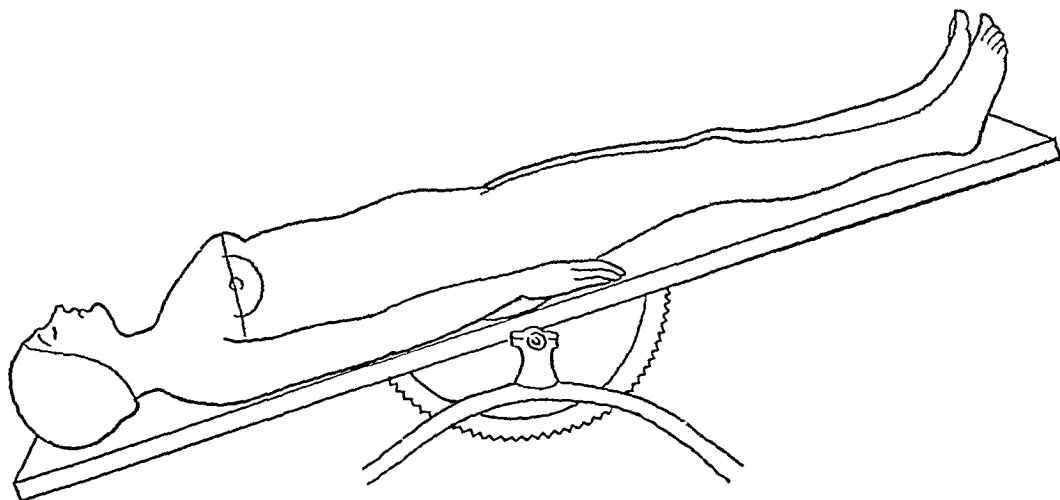
FIG. 6. Life. Level of anesthesia not disturbed when head is lowered.

be prepared extemporaneously. Novocaine dissolved in cerebrospinal fluid is the simplest and at the same time the safest solution. The author's experience with neocaine (French novocaine) covers a period of over twelve years during which he has recorded no death under spinal anesthesia.

The wholesale use of spinal anesthesia should be discouraged and its application throttled down to surgical necessities. Its simplicity of technique and clinical advantages over all the other methods of anesthesia have served in the past to stimulate its routine administration by the inexperienced. It was given to all classes of patients for all types of operations. We believe that this was the first great mistake which led spinal anesthesia to the brim of disrepute. The fear of the gravitation of the drug to the brain gave it the final blow.

Now that confidence has been restored to the method and interest revived in it, we should do our utmost to use it with discrimination but not try to obtain from it more than it can give. There are other procedures of regional anesthesia which give entire satisfaction for operations on the head, neck and thorax. The use of spinal anesthesia for surgery of these

the different methods of Jonnesco, LeFilliatre, and Delmas and have refrained from recommending them, because they are not safe enough to be popularized. They still involve an element of risk much greater than when spinal anesthesia is intended for operations below the diaphragm. We should not make an abusive use of spinal anesthesia for fear of losing one of the best instruments of our armamentarium.

Summarizing the dangers of spinal anesthesia and the ways and means of eliminating such dangers, we believe that:

1. Puncture of the spine and injection in the cervical and upper dorsal regions being associated with comparatively greater risks than elsewhere, the induction of spinal anesthesia routinely for operations upon the head, neck and thorax unnecessarily increases the burden imposed upon the patient by the operative procedure itself.

2. The use of spinal anesthesia for such operations as can be performed satisfactorily with other procedures of the regional method introduces into the general practice of surgery undesirable elements in the estimation of operative prognosis.

3. The induction of general analgesia

by subarachnoid block for operations upon the head, neck and upper thorax is out of proportion to the extent of the surgical intervention and is clinically unsound.

4. The induction of spinal anesthesia for operations below the diaphragm is absolutely safe when all the details of technique are scrupulously observed.

5. The combination of details of technique taken from different sources is considered unwise and may lead to deplorable results.

6. Contraindications to the use of spinal anesthesia being based chiefly upon physiologic considerations, it is of the utmost importance that these considerations be well known so as to avoid disaster.

7. Any technique which is based on the principle of diffusion or gravitation of the injected fluid to the brain introduces into the method one of the biggest adverse factors in the achievement of end-results.

8. Any technique which implies the injection of solutions precluding the use of the Trendelenburg position immediately after the injection is detrimental to health and may endanger life.

9. Any technique which involves control of the level of anesthesia in utter disregard for the protection of the patient against acute anemia of the brain is dangerous to life.

10. Any technique which rests upon the fundamental principle of circulatory disturbances and attempts to cushion by posture the abruptness of such disturbances is of the highest clinical value.

Note: Illustrations used in this paper are from the author's (1) "Regional Anesthesia," Nelson's Loose Leaf Surgery, Chap. ix, N. Y., 1928. (2) Regional Anesthesia, Its Technique and Clinical Applications. Ed. 2. Phila., W. B. Saunders Co., 1928.

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EDITORIALS

THE PAST, PRESENT AND FUTURE OF SPINAL ANESTHESIA

THE history of spinal anesthesia, more properly analgesia, is intensely interesting. It is no new procedure offered the surgeon to simplify and safeguard his work. About three decades ago it had a limited vogue in certain centers in this country and in Europe. It then failed to attain the popularity its advocates hoped for, and very few men did very much with it. There was a reawakening of interest just prior to the World War, which interest waned and fell to a low ebb. About five years ago there were rumors of surgeons in many sections of the country employing spinal anesthesia. It became a topic for scientific discussion. Medical and surgical journals published articles on various phases of the subject. And then, almost overnight, it seemed that the subject took a conspicuous position in the minds of hundreds of surgeons. We have heard it debated pro and con in hospital staff-rooms, its advocates as rabid in its favor

as its opponents were the reverse. With our interest aroused we "discovered" several surgeons who had been employing the method for many years.

Spinal anesthesia may be said to have begun with Nierman who, in 1859, discovered the alkaloid of coca leaves, to which the name of cocaine was given. In 1862 Schraff found that cocaine had local analgesic properties. With this fact amply proved Koller,[1] in 1884, suggested its employment for surgical purposes.

Corning plays a conspicuous part in the early history and experimental work of spinal anesthesia. He published a paper[2] in 1885 on spinal analgesia. Corning was influenced in his conclusions by the work of Harley, who showed that a poison such as strychnine, injected under the membrane covering the cord, "can act only through the intermediation of the blood vessels, since, when the latter are separated from the cord, the solution remains entirely

inert." From this Corning concluded: "In order to obtain the most immediate, direct, and powerful effects upon the cord with a minimum quantity of a medicinal substance, it is by no means necessary to bring the substance into direct contact with the cord; it is not necessary to inject the same beneath the membranes, as in the case of the frogs, since the effects are entirely due to the absorption of the fluid by the minute vessels. On the other hand, in order to obtain these local effects, it is first necessary to inject the solution in the vicinity of the cord; secondly, to select such a spot as will insure the most direct possible entry of the fluid into the circulation about the cord."

Corning first conducted experiments on dogs and then upon a man. In 1888 he published a report[3] of his injection of cocaine hydrochlorate in the immediate neighborhood of the cord.

Corning made the injections in the lumbar and dorsal regions and so antedated by three years the work of Quincke[4] with lumbar puncture. However, Quincke discovered, independently, as he was not aware of Corning's work, that it was possible to remove the cerebrospinal fluid after lumbar puncture apparently without danger to the patient.

Following the work of Corning and Quincke many men experimented to learn the effect of medicinal fluids upon the spinal nerves and cord. Therefore, it was natural that someone should propose the injection of such substances through lumbar puncture (Ziemssen[5]).

Sicard[6] published a report of a series of experiments in which he injected into the subarachnoid space various substances: normal salt solution, morphine, tetanus toxin and other substances, and later he reported[7] the results of his work on the toxic effects of cocaine when introduced into the subarachnoid space through the intracranial or spinal route. Jaboulay confirmed Sicard's findings.

In 1894, Corning published an account of his method of irrigating the cauda equina with medicinal fluids. While doing this work he became impressed with the desirability of introducing the remedies directly into the spinal canal, "with a view to producing still more powerful impressions upon the cord, and more especially upon the lower segment."

Corning's studies evidently made no impression, despite the fact he suggested the surgical application of the method[8] and no one took the hint until Bier, of Kiel, demonstrated its entire feasibility and published the result of his labors.[9]

Bier's paper established the surgical application of spinal analgesia. Bier observed the effects of analgesia induced by this method upon himself, his assistants, and six patients. Lumbar puncture, after the method of Quincke, was employed. The skin was rendered insensitive to the needle by means of Schleich's infiltration. He used 2 c.c. of 1 per cent solution of cocaine.

After the appearance of Bier's paper many surgeons throughout the world, especially in America and France, adopted the method.

The first surgical operation performed in America under spinal analgesia is credited to Tait and Caglieri. They did an ostectomy of the tibia on October 26, 1899.[10]

The procedure was "popularized" by Tuffier[11] who extended surgery under "spinal" to the genito-urinary organs and the abdomen.

Then many men proceeded helter-skelter to attempt surgical operations under spinal analgesia. They did not stop to consider technique or contraindications. They were rewarded with fatalities, causing the method to be placed in a bad light. Bier protested[12] against the recklessness with which the method was being employed, "regardless of the fact that no noteworthy improvement in technique has been evolved." New methods, Bier said, should be devised "in an attempt to reduce the toxicity of the drug and to prevent the unpleasant by-effects so often noted." This, in time, was followed by a large

amount of experimental work to accomplish this end, and the work is still going on. As a result there are nearly a score of "drugs" advocated, each one claimed to have an advantage over the others. At present some three or four drugs find favor with the surgeon.

Kreis[13] is the first credited with having employed subarachnoid analgesia in obstetrics. Doléris, Marx, Dupaigne and others utilized the procedure for the same purpose.

Tait and Caglieri[10] in 1900 reported 3 cases in which cocaine was injected into the sixth cervical interspace without untoward results.

Also, it was in 1900 that Morton[14] presaged the recent extension of spinal analgesia to surgical operations upon all parts of the body. In 1901 he reported 253 operations he had done under spinal analgesia, and 8 of the operations were performed above the diaphragm. In another series of 61 cases, 15 were upon the upper extremities or head.

We quote from Gwathmey's work on anesthesia:[15]

It appears that the work of Tait and Caglieri, Morton, and others, with high injection, has not been followed up with further published clinical application, for which reason, perhaps, originality in this regard has been generally accorded to Jonnesco.

In Sept. 1908, before the Congress of the International Society of Surgery, in Brussels, Jonnesco,[16] described his new method of general spinal anaesthesia and reported 14 cases operated upon by this method.

In a later article[17] he says, "It is an error to confuse lumbar rachianesthesia, conceived by Corning and popularized by Bier, with my method. As I have many times emphasized, my method is a new one and altogether distinctive, because I have generalized spinal anaesthesia, adopting it to *all* operations on *any* part of the body."

Jonnesco added strychnine to the analgesic solution and for it claimed originality. But Gwathmey of New York City, in 1903, used strychnine hypodermatically in conjunction with spinal analgesia.

In Great Britain, Barker, McGavin and Leedham-Green did much to bring this method into favor. Tyrrell Gray showed the method to be applicable in the surgery of young children.

Within recent times there has been a general agreement as to the indications and contraindications to spinal analgesia. Likewise, the technique has been standardized with only minor modifications. Those who advocate the method are insistent that it is a safe procedure, provided the details of technique are followed to the nth degree. When fatalities are heard of as happening "on the table" investigation usually reveals that an error, or errors, in technique were committed. Blomfield, in his work "Anaesthetics,"[18] says: "The majority of workers prefer to limit the use of spinal analgesia to operations below the level of the umbilicus." Abroad, however, especially in Vienna, this does not hold true. And in this number of The American Journal of Surgery, Koster makes a plea for surgery, especially of the head, neck and thorax, under spinal analgesia. But the reader will note in his article a warning to the effect that additional study and research will have to be done in order to understand the effect of drugs on the bulb before it will be entirely without danger. Babcock, one of the pioneers in this method, reviews over two decades of his experiences with spinal analgesia. Pitkin, who received serious consideration at the meeting of the American College of Surgeons at Boston this year, has done both research and experimental work and draws his conclusions from them. Cosgrove adds a chapter to the use of spinal in obstetrics and thus revives work done nearly thirty years ago with this method in the field of child-birth.

Evidently, with drugs that are within the limits of safety, a fool-proof technique, with absolute indications and contraindications given due consideration, spinal

analgesia has passed the threshold of doubtful applicability and is about to receive wide recognition. Within the year, we have no doubt, reports will come in from scores of surgical centers giving results with this form of analgesia. Upon such verdict will depend whether or not surgery under spinal analgesia becomes a routine commonplace.

However, one word of warning is in order at this time. A casual consideration of the subject and a hurried reading of the technique and concomitants, may lead one to think it an easy thing to attempt and without danger. Nothing is further from the truth. Spinal analgesia is not without danger and it takes practice before one becomes familiar with every detail of the procedure. After reading "up" on the entire matter, it behooves any surgeon, new to this method of analgesia, to visit one of the acknowledged experts in this field, and remain with that one for a time sufficient to reward the seeker with a knowledge of every phase and angle of the method, before he returns to his home clinic and makes it a routine part of his work.   T. S. W.

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CONCERNING SPINAL ANESTHESIA

A LETTER FROM DR. RUDOLPH MATAS

[Early in November, Dr. Elwyn Clarke, of the publishers' staff, addressed a letter to Dr. Matas of New Orleans, concerning various phases of spinal anesthesia. Dr. Matas sent an immediate reply. As the reader will note, this letter is out of the ordinary. Therefore, we wired Dr. Matas for permission to publish it. In his answer Dr. Matas said it was not intended for publication but if we would make this plain we could incorporate it in this number of THE AMERICAN JOURNAL OF SURGERY.   Ed.]

November 16, 1928

Dr. Elwyn Clarke,
    c/o Paul B. Hoeber,
        76 Fifth Avenue,
            New York City
Dear Dr. Clarke:

Replying to your appreciated letter of November 8th., I would state:

1. That my first successful spinal analgesia was obtained in an operation for hemorrhoids by injecting a 1 per cent solution of cocaine in the spinal canal between the 4th and 5th lumbar vertebrae, on December 10, 1899. A previous attempt made on Nov. 10, 1899, failed to obtain complete anesthesia on account of insufficient dose of beta eucaine.

A short report of these experiences is given in the *Journal of the A. M. A.*, Vol. 33, under Medical News, p. 1659, for December 30, 1899.

Tait and Caglieri, of Los Angeles, appear to have applied the method in operating for

osteomyelitis on Oct. 26, 1899, but did not report their case until April, 1900.

You will find further reference to these early applications of spinal analgesia in my practice, in a footnote to Chapter 20, p. 432, of Allen's "Local and Regional Anesthesia," 1st. & 2nd. editions, 1915–1918, Saunders & Co., to which I wrote an introduction. Also in a Report on "Local and Regional Anesthesia with cocaine and other analgesic drugs—the latest methods," as chairman of the Section of Surgery of the Louisiana State Medical Society, at the meeting held April 19–21, 1900, and of which I am sending you a reprint.

I also wrote on the same subject in a paper which appeared in the Philadelphia Medical Journal for Nov. 3, 1900. You will find a little more on my experience in spinal anesthesia in this publication, which is now extinct but is, no doubt, available in the New York Academy of Medicine.

I am also sending you reprint of a paper by Dr. Graffagnino, which summarizes the experience of the Charity Hospital of New Orleans in spinal anesthesia from 1899–1925.

2. In regard to your query as to the name of the "New Orleans doctor (Louisiana French) who gave spinal anesthesia for me a good many years ago and has since died," I can only think of the late Dr. Sidney P. Delaup as the one you refer to. Dr. Delaup adopted genitourinary and rectal surgery as his specialty and resorted to spinal anesthesia almost exclusively in his practice. He assisted Dr. Charles Chassaignac who was chief of the genitourinary service at that time and did most of the spinal injections for him. Dr. Delaup was not a member of my staff and took up spinal anesthesia long after I had introduced it in the Charity Hospital. Dr. Delaup published his first paper on spinal anesthesia in the *Transactions of the Louisiana State Medical Society* for 1901, pp. 359–368 and *New Orleans Med. and Surg. J.*, 1901–02, pp. 211–219. In this paper he reported his first thirty (30) cases, which are given synoptically and *without dates*. He reported a total of one hundred (100) cases in a second paper which appeared in the *New Orleans Med. and Surg. J.*, Vol. 57, Feb., 1905, but without dates. His chief, Dr. Chassaignac also wrote on his experience dating from the Fall of 1900–1905 in which he refers to Dr. Delaup and Dr. Paul J. Gelpi as his assistants in the work.

3. In the nearly twenty-nine (29) years that have elapsed since my first application of spinal anesthesia, the method has gone through many variations in the technique and in the anesthetics used. Beginning with cocaine we have gone through the gamut of its synthetic substitutes,—beta eucaine, stovaine, alypine, tropococaine, apothesine (P. D. & Co.) tutocaine, novocaine in a variety of solutions and methods of administration have had their advocates and detractors. Apothesine was used almost exclusively in the Charity Hospital during the world war and has remained the favored agent with the staff until quite recently, at least in so far as spinal analgesia is concerned; novocaine and adrenaline being always preferred for local, regional and splanchnic anesthesia. At present, novocaine seems to be coming to its own in spinal anesthesia as one of the components of the *spinocain* solution that Dr. G. P. Pitkin has introduced. The results of this method of "controllable anesthesia" have thus far created a very favorable impression, but it is too early to express a definite opinion as to its comparative merits.

As far as I am personally concerned, I resort to spinal anesthesia only for operations in the lower half of the body—particularly the pelvis; genitourinary tract; rectum and lower extremities. I find it particularly advantageous in operating upon femoral and popliteal and tibial aneurisms, where the patient has often to be turned on his face to expose the operative field. Personally, I have always preferred novocaine (procaine) to all other anesthetics, ever since it was first introduced. I have never attempted to obtain a general anesthesia (below the neck) by spinal injection as practiced by Jonnesco, Tait and others. In

the abdomen I have made it a rule never to resort to spinal anesthesia in weak, exhausted and hypotense subjects. As a whole my conclusions as to the indications and contraindications of spinal anesthesia have been those arrived at in the conservative and discriminating report presented by Prof. Forgue of Montpellier, at the French Congress of Surgery in Paris last October (1928)—(see *Presse Médicale* No. 83, Oct. 17, 1928). I believe that in the matter of anesthesia one should be selective and eclectic and not a routinarian.

It is quite possible that the indication for spinal anesthesia will be enlarged with greater safety and advantage than in the past, particularly in the abdomen where absolute relaxation is desirable without a fall in the blood pressure, by adapting Pitkin's method and solutions. We should remember however, that while spinal anesthesia has been evolving to its present stage of efficiency and relative safety (within its proper regional limitations) general anesthesia has also enormously improved since we have learned how to use the ethylene-oxygen combination in the apparatus and safety devices of modern practice. Of one thing I am quite convinced and that is, that spinal anesthesia as it is now evolving to a place of greater safety, will completely supplement the methods of splanchnic anesthesia which have rendered an excellent service in abdominal surgery in the last few years, but which are less dependable, more complicated and quite as risky and require more expertness for their proper application than either a spinal anesthesia or an ethylene-oxygen combination in competent hands and in modern technical conditions.

Hoping that this letter will satisfy your inquiries, I am

<div style="text-align:right">

Yours very truly,
(Signed) R. MATAS.

</div>

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

THE ALLEN MEMORIAL MEDICAL LIBRARY OF CLEVELAND, OHIO *

Ruth F. Stone

CLEVELAND

THE recently completed Allen Memorial Medical Library in Cleveland, Ohio, is filling a long-felt need of the Medical Library Association for attractive and adequate housing of its rapidly growing library. Its present new location, closely adjacent to the area to be devoted to the new Medical Center for which $6,000,000 has been subscribed, as well as its convenient location to the Western Reserve University Center, makes it easily available to all concerned in the study, research and practice of medicine in Cleveland.

Since its organization in 1893 and its incorporation the following year, the Cleveland Medical Library Association has been gathering medical books and journals of increasing value. This collection was housed for some years in the old Case Library but in 1897 the number of volumes had so increased that it became necessary to provide separate housing for them. The result was the purchase and adaptation for library uses of a residence at 2318 Prospect Avenue, Cleveland.

During the following period of twenty-five years, the Library Association grew in membership and became the beneficiary of various bequests and trust funds from its former members for the promotion of the Library's interests. The acquirement of books and journals over the same period was so considerable that for some years past much consideration has had to be
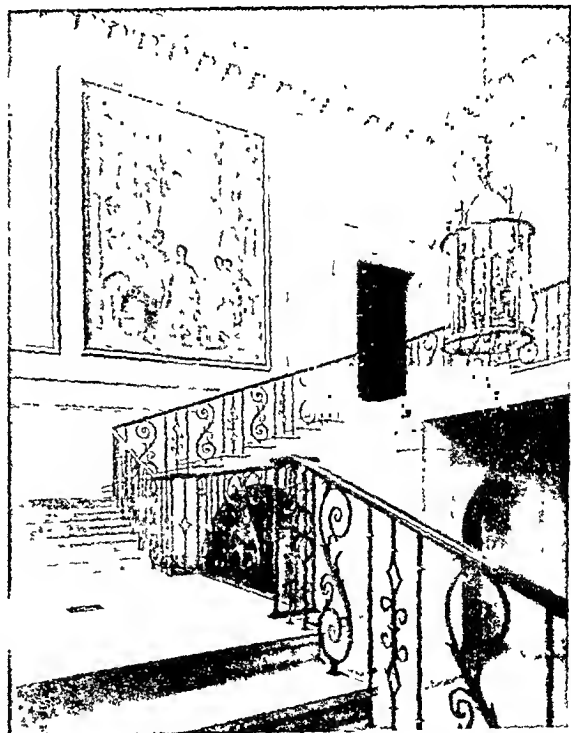
Fig. 1. Entrance and main hallway. Showing one of four murals decorating the upper walls. These murals portraying the history of medicine were painted by Cora Holden, Cleveland.

given to the embarrassing needs of the Library for better and larger housing.

After the World War and the return to

* Submitted for publication June 25, 1928.

Cleveland of many physicians engaged in war service, active efforts of the Medical Library's Trustees resulted in the appoint-

site on the corner of Euclid Avenue and Adelbert Road. Contingent upon the acceptance of this new site came the offer
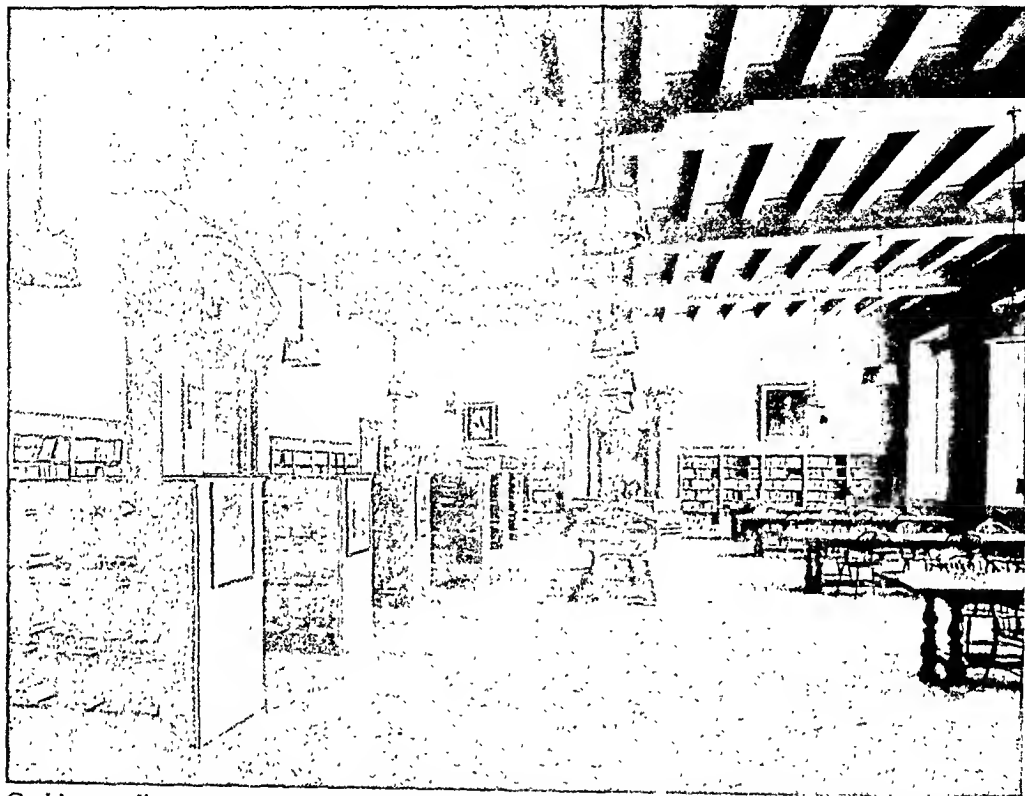
FIG. 2. Cushing reading room. Memorial to three generations of distinguished physicians in the Cushing family of Cleveland.

ment of a building committee, and the employment of Walker and Weeks, architects of Cleveland, to plan for a new building to be located on the Prospect Avenue site. At about this time the Western Reserve University was making elaborate plans for a future Medical Center to be located on property adjacent to the University. This Medical Center is to include maternity, babies' and general hospitals, nurses' homes, medical, dental and research laboratories as well as the medical school, all these units to be gradually moved from old buildings to the new location as fast as means and opportunity would permit.

Realizing the value of having the Medical Library a part of this new grouping in the Medical Center, the Western Reserve University gave the Cleveland Medical Library Association a handsome

from Mrs. F. F. Prentiss, formerly the wife of Dr. Dudley P. Allen, deceased, a Cleveland surgeon of prominence, of a most generous part of the money to erect a suitable building, the structure to be called the Allen Memorial Medical Library.

These offers were gratefully accepted. An appeal was then made to the medical profession and to relatives and friends of former physicians for funds properly to furnish and equip the new building. The result was the contribution of $175,000 additional for this purpose.

The structure was completed and ready for dedication on November 13, 1926, upon which occasion the oration of the day was delivered by Dr. Harvey Cushing, of Boston, a member of the third generation of distinguished Cleveland physicians in the Cushing family.

The new Allen Memorial Medical

Library is of the classical type of architecture, a simple but well-proportioned edifice of limestone, with base, entrance door, jamb and ornamental vases of pink Georgia marble. The construction is of concrete, steel and other fireproof material.

The use of marble in the Medical Library has worked out most satisfactorily, beginning with the marble on the exterior. The visitor is introduced to this material as he passes through the main entrance. On entering the main hallway from the portal, he perceives that he is in a dignified, quiet and pleasant room that extends through two stories and is the chief feature of the interior arrangement. The marble in this room is entirely of Tennessee Tavernelle and it is mainly due to its use that the impression of serenity is so readily achieved.

The upper part of the main hallway carries out in color the same general tone of the marble and furnishes a most satisfactory background for four large pictures. These murals portray the history of medicine as typified in the life of Asklepios. The following wording appears upon a tablet that hangs on the landing of the stairway, explanatory of this legend:

The Murals
Given in memory of Dr. Walter Merriam by Mrs. Merriam, portray the
Story of Asklepios

I. The legend is that Asklepios, son of Apollo, was instructed in the art of healing by Cheiron, most celebrated of the Centaurs, who was versed also in philosophy, music, astronomy, and the arts of the chase and of war.

II. Asklepios is referred to in ancient writings as "the much honored" and "beloved" physician. Many statues of him have been found, always with the snake, his symbol, coiled about his staff.

III. Machaon, warrior-son of Asklepios, accompanied King Agamemnon against Troy, acting both as surgeon and leader of troops. Agamemnon sends for Machaon to aid the wounded Menelaus.—Iliad, Book 4.

IV. Asklepios, deified by the Greeks, was worshipped in many temples. His sanctu-

aries, notably at Cos and Epidaurus, were sought out by ill and maimed. Asklepios was Aesculapius of the Romans, and to the modern world is a recognized symbol of medicine.

Painted by Cora Millet Holden.

Miss Holden, an artist of Cleveland, is a young woman who is making a name for herself in the field of murals. Previous to the painting of the four murals for the Medical Library, Miss Holden painted two war murals in the Memorial Hall of the Goodyear Company, Akron, Ohio and an industrial mural in the Federal Reserve Bank of the Fourth District in Cleveland.

In addition to the main hall described in the foregoing, the Medical Library contains the large Cushing reading room, the Hunter H. Powell room or member's reading room, an assembly hall seating six hundred, a lecture room with a capacity for ninety-five, large dining room and kitchen, offices of the Cleveland Academy of Medicine, a suite of three reading and lounging rooms, librarian's office and workrooms, a large museum, three committee and seminar rooms, space for seventeen private studies, stackrooms with a capacity for 125,000 volumes and living apartments for the librarian.

These rooms are all handsomely decorated and furnished, and added dignity and character is given them by the many old and interesting portraits of former members, as well as a very fine collection of etchings. The cost of the building, its decoration and furnishings, was approximately $650,000.

BOOK REVIEWS

This translated work by Dr. Cemach, SURGICAL DIAGNOSIS IN TABULAR OUTLINE[1] is either one of those things one likes and will defend stoutly, or else a thing for which he has

[1] SURGICAL DIAGNOSIS IN TABULAR OUTLINE. By A. J. Cemach, M.D. Authorized Translation, with additions and notes by Edward L. Bortz, M.D. With an introductory note by John B. Deaver, M.D. 8vo, cloth. Pp. 29, (Biblio. & Index), 238 Tables & Plates, 548 Subjects. Phila., F. A. Davis Company, 1928.

no use whatsoever. Personally, we like the book. We think it will prove interesting and helpful to many physicians. It is not a new method of presenting a subject. Most teachers use the general scheme more or less.

The work is just what the title indicates, a tabular outline of surgical diagnosis. It is thorough and the accompanying illustrations are very helpful. It is a work most physicians can well afford to have handy on their desk to consult when in a hurry to clear up a doubtful point or problem in diagnosis. It is well printed, the illustrations have been reproduced well and the publishers are to be congratulated in offering the book to the medical public, who might well take advantage of a handy method of making a differential diagnosis without having to wade through book after book and endless pages of text.

Dr. Braun has written a most creditable book on SINUS THROMBOPHLEBITIS.[1] In addition he has illustrated it with splendid drawings. It is an unusual combination of author and illustrator, both excellent in their chosen field.

The student could use this book with profit. The physician confining his work to ear, nose and throat conditions should have it on his library shelves. Many general surgeons operate when cases of sinus thrombophlebitis are referred to them and, therefore, will find Braun's book instructive.

The volume is divided into five chapters: 1. Development; 2. Anatomy; 3. Etiology and Pathology; 4. Symptoms and Diagnosis; 5. Treatment. There is a bibliography that covers eleven pages. To the student and research worker this, alone, will prove most valuable.

It is well indexed.

It is a worth while work, beautifully done by the publishers, the type large and readable and the illustrations well reproduced.

We earnestly recommend it to those interested in this subject.

This book THE FUNDAMENTALS OF HUMAN MOTIVATION[2] is a systematic treatment of the facts and problems of human motivation.

It is an answer to: Why do people behave and feel as they do? What are the foundations of impulse, desire, emotion, purpose and habit?

We quote from the Preface: The following questions should be of interest to any conscious human being (they are discussed in the book): (1) Our inborn tendencies to action; (2) the means by which we learn; (3) the basis of "pleasure and pain"; (4) the foundations of "happiness" in general; (5) the nature and operation of "instincts," such as that of sex; (6) the physiological meaning of the Freudian "complex"; (7) the nature and foundations of emotional experience; (8) the explanation of typical modern interests, automobiles, radio, etc.; (9) suggestions towards a scientific treatment of the problems of ethics.

The book is in no way a popular discussion. Rather, it is a scientific analysis of the motivanal problem.

It is well written and authoritative.

It is a book we recommend to physicians and other educated persons.

This monograph, L'EXPLORATION RADIOLOGIQUE EN GYNÉCOLOGIE,[1] thoroughly covers the subject of radiological exploration in gynecology.

The first part deals with on pneumoperiteum; the second part with insufflation of the tubes, and the third part with the opaque injections. There follows the technique, written in quite some detail. The morphology of the uterus and tubes is given space, as is the normal physiology and psychology. The closed tubes and pelvic pathology are discussed. The book is well illustrated.

To those particularly interested in tubal insufflation, and the work that is being done abroad, as contrasted with the pioneer work by Rubin and others in this country, this book is recommended.

Anyone interested in and "doing" general surgery will be intrigued with this book, RECENT ADVANCES IN SURGERY.[2] It seems a small work on picking it up, but is really quite lengthy.

The author deals with the latest thought

[1] SINUS THROMBOPHLEBITIS. Inflammatory Diseases of the Venous Sinuses of the Dura Mater. By Alfred braun, M.D. 8vo, cloth, Pp. 283, 111 illus. N. Y., Paul B. Hoeber, Ine., 1928.

[2] THE FUNDAMENTALS OF HUMAN MOTIVATION. By Leonard R. Troland, A.M., PH.D. 8vo, cloth. Pp. 525. N. Y., D. Van Nostrand Co., Ine., 1928.

[1] L'EXPLORATION RADIOLOGIQUE EN GYNÉCOLOGIE. Technique. Resultats. By Claude Béclère, M.D. Preface by R. Grégorie, M.D. 8vo, cloth. Pp. 174, illus. Par., Masson et Cie, 1928.

[2] RECENT ADVANCES IN SURGERY. By W. Heneage Ogilvie, M.D., M.CH., (Oxon.), F.R.C.S. (Eng.). 12mo, cloth. Pp. 468, 108 illus. Phila., P. Blakiston's Son & Co., 1928.

regarding several surgical conditions. A chapter is devoted to shock and hemorrhage and local anesthesia. There is a chapter devoted to the topic of cancer and two chapters to neurosurgery. Surgery of the mouth and pharynx; plastic surgery; the thyroid and parathyroid; the heart and blood-vessels; chest surgery; the abdominal wall and hernia; the stomach; the peritoneum and large intestine; the gall bladder; the urogenital system; the surgery of bones, joints and muscles; and venereal disease, plus an index, comprise the book.

This may seem a whole lot in one book of less than five hundred pages, but the author has wisely eliminated the apparent and unnecessary, he has avoided discussion and knows the art of saying a lot in very few words.

To surgeons we recommend this book.

This book, A Textbook of Fractures and Dislocations,[1] which now appears in its second edition, shows a very considerable amount of change from the first edition. Also, its typographical arrangement is greatly improved; this last having evidently been done to add to its value as an undergraduate textbook.

The text itself is not particularly well balanced, emphasis on certain types of fractures being, the reviewer feels, excessive and other types not receiving sufficient amount of attention. It is, however, the author's own valuation of his subject matter and must be received and considered as such. The discussions of pathology are meager and a new edition of the text should see this material amplified. The manner in which treatment is covered shows that the text comes from the pen of a competent, accurate, thinking authority and when judged from the standpoint of treatment, will prove of value either for general or special reference. It will prove to be particularly of value, we believe, to the mass of general practitioners who are obliged to treat fractures and dislocations.

The authors say in their preface to Urology[2] that "daily contact with the general practitioner and medical students in our clinics has impressed us with the lack of a textbook on Urology which presents the subject in the simplest possible manner."

From this premise the authors have written a splendid treatise covering the entire field. The illustrations, over 700 in number, are well selected and well reproduced. There is no padding; the book is full of meat and appears to be thoroughly up to date. References are made in the form of concise footnotes and there is no bibliography added. The excessive use of bold faced type is a bit startling and interferes with consecutive reading; for quick reference, however, this may be found very desirable.

This book, Blood and Urine Chemistry,[1] is intended to be a textbook for laboratory workers and practitioners of medicine. After going through the pages of the book we turned to the preface and discovered this fact, which we had already concluded to our innerself.

In these days blood and urine chemistry play an important part in the diagnosis and prognosis of disease. Treatment, naturally, is based on the diagnosis and particularly on the state of the blood and urine.

Naturally, every laboratory worker keeps at his elbow several reference books. This work should be included in the list. It is thorough, authentic, well written and the illustrations truly illustrate the text.

To the internist and physician who does his own laboratory work this book will be useful.

Had we our way we'd have the faculty of every medical school in the country see that their graduates owned a copy of this work. It would stand by these graduates throughout their active years (or until newer and more modern works appeared) and raise the level of the excellence of medical practice.

We do not attempt a review of this work, Diseases of the Ear, Nose and Throat.[2] It has been reviewed countless times. The best review of any work is to read on the title page that it has gone through several editions. The fact that Dr. Phillips' book is now offered in its seventh edition is proof that it is a distinctly worthwhile publication.

Dr. Phillips needs no introduction to an American audience. He has been preeminent in two fields. He has served the profession and aided in raising medical standards. To

[1] A Text Book of Fractures and Dislocations. Ed. 2. By Kellogg Speed, s.b., m.d., f.a.c.s. 8vo, cloth. Pp. 952, 987 illus. Phila., Lea & Febiger, 1928.

[2] Urology. By Daniel Eisendrath, m.d., and Harry C. Rolnick. m.d,. Phila., Lippincott, 1928.

[1] Blood and Urine Chemistry. By R. B. H. Gradwohl, m.d., and Ida E. Gradwohl, a.b. 8vo, cloth. Pp. 542, 121 illus. St. Louis, C. V. Mosby Company, 1928.

[2] Diseases of the Ear, Nose and Throat. Medical and Surgical. Ed. 7. By W. C. Phillips, m.d. 8vo, cloth. Pp. 942, 615 illus. Phila., F. A. Davis Company, 1928.

this end he was honored, after having been honored by every office on the way, to the presidency of the American Medical Association. He has achieved distinction in his special field of surgical endeavor. And this is reflected in the pages of his book.

If there is a physician specializing in ear, nose and throat conditions who does not possess Dr. Phillips' volume we urge him to do so at once. To the practitioner who wishes to have a handy book on the subject as a reference work, we strongly recommend that he purchase this one.

The preface says: "The aim of this book, A TEXT-BOOK OF PHARMACOLOGY AND THERAPEUTICS[1] is to present clearly the important facts of pharmacology and to give the basis for these facts . . . an attempt has been made to connect physiology, biochemistry and pharmacology with clinical application."

The author has fulfilled these aims.

Were we asked to name a two foot medical bookshelf this volume would be among those chosen.

The average physician is dolefully weak on his pharmacology and therapeutics. We point out to him that if he will take ten minutes a day with Dr. McGuigan's book until it has been read from cover to cover and then keep the book handy as a reference work, he will practice better medicine, ease the life of the druggists and make happier the lot of mankind.

It is an excellent book from every angle.

Every physician who employs nurses or works in a hospital with a training school for nurses; every nurse graduated from a recognized hospital and every other person interested in the economic side of sickness will read and reread this book, NURSES, PATIENTS AND POCKETBOOKS.[2]

It is a reference book. The chief purpose of the book is to stimulate constructive thought and discussion.

We cannot go into detail regarding the reading matter but in order to give an idea of the contents the reader will note the following chapter heads: How Fast Has Nursing Grown? How Far Is It Going? Is There Unemployment Now? Are Physicians Satisfied? Are Patients Satisfied? What Are Nurses Like? How Do Nurses Like Their Jobs? Who Produce The Nurses? Why Be Concerned? The Free-Lance Nurse; Nursing The Country Patient; and The Hospital and The Graduate Nurse.

There are 70 tables and 61 diagrams.

MODERN X-RAY TECHNIQUE is a splendidly prepared volume of over 250 pages, divided into 21 chapters and splendidly indexed.[3] A concise yet complete work for the X-ray technician is here presented. It has an advantage over most books in that it covers exactly the field it is intended to cover, no more and no less. The technician who masters the contents of this book will be able to handle roentgen apparatus properly and should take good roentgenograms. He will have learned, too, that his work ceases there and that the interpretation of the roentgenograms is up to the physician in charge. A book, therefore, that should be in the hands of every roentgen-ray technician. Medical men, also, will find it a book worth having on their shelves for it answers quickly many technical questions that are not covered in the usual roentgenological publications. We congratulate both the author and the publisher upon the issuance of a work that has long been needed.

[1] A TEXT-BOOK OF PHARMACOLOGY AND THERAPEUTICS. By H. A. McGuigan, PH.D., M.D. 8vo, cloth. Pp. 660, illus. Phila. W. B. Saunders Company, 1928.

[2] NURSES, PATIENTS AND POCKETBOOKS. Report of A Study of the Economics of Nursing Conducted by the Committee on the Grading of Nursing Schools. May Ayres Burgess, Director. 8vo, cloth. Pp. 630, 61 diagrams. N. Y., 1928.

[3] MODERN X-RAY TECHNIQUE. By Ed. C. Jerman. 8vo, cloth. Pp. 260, illus. St. Paul, Bruce Publishing Co., 1928.

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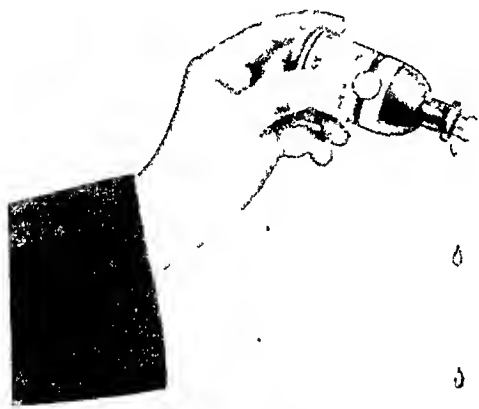
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CONTENTS—JUNE, 1928
ORIGINAL ARTICLES

CONTENTS—JUNE, 1928

Continued from page i

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DIAGNOSIS AND TREATMENT OF
COLONIC DIVERTICULA

JAMES T. CASE, M.D., F.A.C.S., D.M.R.F.(CAMB.)

BATTLE CREEK, MICHIGAN

THE rapidly growing literature on diverticulosis and diverticulitis indicates the increased attention being paid the subject in recent years. Although recognized and described as long ago as 1849 by Cruveilhier,[1] and by Virchow[2] in 1853, our real knowledge of this subject has developed since Graser[3] in 1898 described the formation of diverticula of the intestine and showed the great frequency with which diverticulosis occurred. Fischer[4] (1901) and Beer[5] (1904) made additional contributions. In 1906 appeared Moynihan's[6] important communication describing the mimicry of cancer by diverticulitis of the colon, and in 1907 Mayo, Wilson and Giffin[7] reported the first series of American cases (5) in which operation had been performed. The first really exhaustive work on colonic diverticula was that of W. H. Telling[8] in 1908. Then followed in rapid succession a series of publications by a great many authors, the outstanding contributors being W. J. Mayo, McGrath Morestin, Lejars and Menetrier, Lockhart-Mummery, Judd, Masson, Spriggs and Marxer.

The original publication of Graser showed how common was the development of diverticular formations in the large bowel, particularly in the sigmoid flexure. He emphasized the hyperplastic stenosing lesion known as peridiverticulitis and called attention to its mimicry of sigmoidal carcinoma.

Wilson[9] further described the secondary changes which followed inflammation of a diverticular sac. Colonic diverticula ordinarily are round or ovoid, having a sort of bottle or flask shape with a narrow neck connecting the sac with the lumen of the intestine. This explains the mechanism of retention of a portion of the fecal content with absorption of fluid and the formation of hard fecal lumps, sometimes as hard as shot. Inflammatory changes occur due to the mechanical irritation of the mass which is aways rich in pathogenic bacteria. The result is edema or induration with compression of the diverticular orifice, the deposit of connective tissue about the sacs producing the so-called peridiverticulitis, and sometimes stenosing tumor formation resembling ileocecal tuberculosis of the hyperplastic type. In other cases acute inflammation occurs with resulting abscess formation and its various sequella.

A great many of the diverticula, especially those in the upper alimentary tract, show no sign of inflammatory reaction and therefore are not really entitled to a descriptive word implying inflammation. Some years ago (1914) the writer proposed the term "diverticulosis" for this condition. It has also been proposed by other

authors including Spriggs and Marxer and de Quervain. However, even in the upper alimentary tract certain of these diverticula undergo active inflammatory changes in and about the sacs and merit the term "diverticulitis." Particularly in the colon, most of all in the sigmoid colon, we find the condition of "diverticulitis."

Various classifications have been proposed. Telling's classification, based on the pathological changes, divides the manifestations of colonic diverticula into mechanical and inflammatory, the mechanical including the formation of fecal concretions in the sacs, torsion of the diverticulum and lodgment of foreign bodies; the inflammatory changes including diverticulitis proper (acute, gangrenous, subacute, chronic and latent). The writer has employed the following as a practical clinical classification.

DIVERTICULOSIS

This group as above suggested includes those relatively frequent cases with few or numerous small hernial protrusions in the wall of the bowel, demonstrable on roentgen-ray examination, but not producing any symptoms referable to the diverticula. Spriggs and Marxer[10] found that ten per cent of their patients examined with the barium meal showed definite evidence of diverticulosis. We believe this figure is perhaps higher than will be found in average practice.

Jordan[11] suggests that colitis is the commonest cause underlying the development of diverticula, but it seems to us the case is more likely just the opposite, that the diverticula cause the colitis and many of these cases of diverticulosis really belong under the next heading. Of course, a vicious circle is soon established so that the two conditions contribute to each other.

DIVERTICULITIS

Enterospasm type, including that type of case in which the diverticula even though numerous are scattered and where the symptoms are apparently only those

of enterospasm, kept up by continuous renewal of intestinal irritation from the retained contents of the diverticular sacs.

Hyperplastic type, in which the diverticula are situated fairly close together, especially in the region of the pelvic colon, where on account of their grouping the peridiverticular inflammatory reaction and the consequent production of connective tissue tends to produce a tumor with resulting organic obstruction.

Pseudoappendicitis type, where one or more of the diverticula, even where the saccules are not generally characterized by peridiverticular inflammation, undergoes an acute inflammatory process analogous to that occurring with acute appendicitis. We may include in this group inflammation of an epiploic tag. Telling called attention to the frequency with which the diverticula are covered over by the fatty epiploic appendages in such a way as to effectually hide the majority of the saccules from discovery by external examination of the bowel in the opened abdomen. An inflammatory process in one of these diverticula covered by a fatty intestinal appendage may result in an appendical epiploitis. The writer has operated on several cases where a single tag was thus involved, cure resulting in such cases from removal of the offending epiploic appendage. On section of the removed tag after operation, we have been able to demonstrate a hidden diverticulum in each case.

SYMPTOMS

Whether or not many cases fall under the heading of diverticulosis really depends on one's conception of what constitutes symptoms. Patients in whom we discover diverticulosis accidentally during roentgen-ray study almost invariably have complained of sufficient physical distress to bring them to consultation with a physician and he has found symptoms enough to warrant a roentgen examination of the colon, else the diverticula would not have been discovered. It is difficult to draw a

sharp line of differentiation between the cases of purely symptomless diverticulosis and the enterospasm type of diverticulitis.

The early symptoms of the group of cases of diverticulitis characterized by spasm of the colon are common to the early stage of many abdominal diseases: vague abdominal distress, slight intestinal upsets, discomfort in the abdomen particularly on the left side but occurring also on the right side. A well developed diverticulitis causes attacks of pain and tenderness over the entire colon, usually more marked in the left lower quadrant but also frequently combined with distress in the right lower quadrant. Bladder irritability is frequent and associated with tenderness over the middle of the lower abdomen. This abdominal tenderness is very commonly encountered and is often accompanied by muscular rigidity. Colics are not rare and when present tend to recur frequently. Moderate irregular fever may come on in attacks through a period of years. Leucocytosis may occur, with or without fever. Constipation is usual although occasionally alternating with diarrhea. Examination of the stools in this group seldom reveals the presence of blood, although in the cases of peridiverticulitis with tumor about one-fifth of the patients show blood in the intestinal excreta.

According to the predominance of certain symptoms, all cases may be classified as above described. In diverticulitis with enterospasm predominating, there is a notable absence of signs of tumor or obstruction, or an acute inflammatory development with suppuration leading to the necessity of urgent surgery. Abdominal distention, colicky pains especially across the abdomen, fever, hyperleucocytosis and other signs pointing to either the obstructive or the pseudoappendicitis type of lesion are absent, but there are the ordinary signs of chronic colitis.

In the pseudoappendicitis type, the patient, usually with a long history of a diverticulitis of the spastic type, suddenly develops acute symptoms demanding urgent attention. These symptoms should be distinguished from the true left-sided appendicitis which occurs only with non-rotation of the colon or in cases of true transposition of the viscera, but otherwise the complaints and signs are quite similar: hyperleucocytosis, fever, pain, tenderness usually over the left side, muscular rigidity, constipation occasionally alternating with diarrhea, localized peritonitis,—all suggesting the need of surgical intervention, at least for drainage of the infected area.

In the obstructive type, the symptoms are those of a long standing constipation with perhaps a history of several acute attacks simulating the so-called left-sided appendicitis but with progressively obstinate constipation, the development of colicky pains, notably across the transverse colon and in the right side of the abdomen, small, frequent stools or impulse to move the bowels without good results, and usually a palpable tumor. This tumor, thought to be due to bacterial inflammation of the intestinal wall, is generally described as sausage-shaped and exhibits intermittency as one of its importans characteristics. The appearance of a mast and its subsequent disappearance, with reappearance within a few days, is one of the most reliable signs of perisigmoiditis due to diverticulitis. This tumor may be felt either abdominally, rectally, or on a combined examination. There may occur a rare case of right-sided diverticulitis indistinguishable from appendicitis and perhaps even suggesting gall-bladder disease; here, as in other parts of the colon, the symptoms will depend somewhat on the exact situation of the inflamed diverticula.

In going about a diagnostic investigation in a case of suspected diverticulitis, it is important first to determine in which segment of the colon the lesion is probably located. The nature of the lesion will then engage our attention, whether inflammatory with suppuration and demanding surgical consideration, or obstructive due

to spasm and to the secondary formation of connective tissue.

The sigmoidoscopic examination offers some help and should always be made. It is occasionally possible by this means to visualize the orifice of one or more of the diverticula, and often one may draw conclusions regarding the rigidity or fixation of the pelvic colon. But a note of warning should be sounded regarding possible danger from the insertion of the sigmoidoscope into a segment of the colon which is the seat of diverticulitis. The writer has been called upon to operate in two cases where urgent acute symptoms followed within a few minutes an attempt at sigmoidoscopic instrumentation; in both cases rupture of a diverticulum had occurred.

Trauma of all kinds must be avoided in cases of suspected diverticulitis. From his series published in 1917, Telling[8] reports the production of acute diverticulitis from trauma as follows: straining at stool, two cases; administration of enema with high pressure, one; following heavy dose of castor oil, two cases; jolting in automodile, two; following a heavy meal, two; while lifting a weight, one; while jumping, one. Several cases occurred during abdominal operation. So not only must one avoid trauma in making a sigmoidoscopic study but even at operation the surgeon must be gentle in handling the diverticulum-bearing bowel.

Examination of the stool seldom gives decisive information. When a tumor or obstruction of the bowel is present, the stool investigation is of some help in differentiating between diverticulitis and carcinoma. The presence of blood or bloody mucus tends to strengthen the diagnosis of carcinoma but it may occur with diverticulitis. Judd and Pollock[12] observed blood in the stool in only 18 per cent of the cases of benign diverticulitis, while in those cases associated with carcinoma it was found in 47 per cent.

ROENTGEN-RAY EXAMINATION

The roentgen-ray study is really the only means of establishing a diagnosis of diverticulosis, and it is of decisive value in detecting diverticulitis. The first operated case, demonstrated roentgenologically before operation, was published by Abbe[13] in 1914, the roentgen-ray examination having been made by L. T. LeWald. The next publications on this subject were by the writer[14] and by the late R. D. Carman,[15] working independently. Both papers were published in February, 1915, the writer reporting thirteen cases, Carman reporting three cases of colonic diverticulitis. Carman thought it best to employ the opaque enema for demonstrating the diverticula, while the writer laid particular stress on the value of the roentgen-ray studies carried to the fourth or fifth day after the opaque meal examination, combined with the barium enema, as giving the maximum amount of information in these cases.

It is now recognized as necessary to employ both the opaque meal and the enema, and to take advantage of both screen and roentgenographic study. It is not enough simply to demonstrate residues in the diverticula, although this of course constitutes the best proof of the condition; we must also obtain all available data having a bearing on the diagnosis, the prognosis and the method of treatment. Some authors claim that in occasional cases the diverticula may defy the roentgenological demonstration, but by the technique which we shall describe it will be possible to show some sign of diverticulitis, even when the diverticula cannot be definitely identified.

The basic facts underlying the roentgenological interpretation of diverticula are as follows: The normal colon shows haustration. The haustral segments are regular and symmetrical except perhaps at the flexures. This segmentation is due to contraction of the muscle fibers and affects all layers of the bowel except the peritoneal coat, which marks the notches between the haustral sacs but does not enter into their formation. The haustra are normally present in a roentgenogram of the colon

whether following the meal or following the opaque injection. In certain states of colitis the haustral formation is inhibited so that the colonic outline is smooth; the more severe the colitis, the more conspicuous the absence of haustra in the roentgenogram. Following the passage of an opaque meal through the colon, one observes in cases of diverticulosis small rounded shadows, evidently residues of the opaque salt in the affected areas. These rounded shot-like residues may be scattered throughout the large bowel but are usually more numerous near the iliopelvic junction; they may be confined to that area. These rounded shadows usually occur in groups, but wherever they occur they maintain the same relation to each other and to the colon when visualized by its gas content or by the opaque enema.

The diverticula are best seen on the second or third day after the opaque meal when by careful screen study, especially during manipulation of the iliac and pelvic colon, one may detect their presence. These shadows sometimes appear shortly after the opaque meal reaches the affected segment but it most often happens that they are not recognized definitely until the second or third day, after most of the opaque material has been evacuated. It is at this moment especially illuminating to administer an opaque enema, carefully studying the rounded shadows in relation to the enema-filled colon. This study may be carried out fluoroscopically, though roentgenograms are especially graphic, and sometimes stereoroentgenograms furnish the most decisive and spectacular evidence. The diagnosis may be made frequently, if not almost always, by means of the enema alone but it is important that in such cases the enema should be retained for half an hour or longer. It usually occurs that in these cases the patient is able to expel the enema only from the rectum and lower pelvic colon, the remainder being retained. Screen or film studies half an hour to an hour later, or even ten or twelve hours later, will frequently demonstrate the filling of the diverticula in cases where they did not show immediately after the enema.

In the first case reported (Abbé), examined by LeWald, the diverticulum retained bismuth up to the tenth day. In one of the writer's cases of multiple diverticula reported in 1915, they were seen still filled on the sixteenth day. Much longer retention than this has been reported by several observers. As above stated, however, it is not sufficient merely to show up the diverticula; it is important to obtain information on several other points, particularly the question of peridiverticular induration, fistulae, obstruction, possible associated carcinoma and adhesions of the small bowel, determination of whether the case is advanced, and in early cases to decide whether or not there exist symptoms which correspond to the prediverticular state, described by Spriggs and Marxer,[10] and which will be discussed in later paragraphs of this paper.

If one definitely suspects a diverticulitis but finds no sign of the diverticula with the opaque meal, it may be helpful to give the maximum physiologic dose of belladonna or atropine during twenty-four to forty-eight hours. Then the usual preparation of the colon by cleansing enemas will considerably increase one's chance of demonstrating the diverticula by the opaque enema. The use of the antispasmodic will also aid in differentiating between an organic stricture and a spastic state, a differentiation very important to make but not always easily accomplished in diverticulitis.

The first notable step in the roentgenology of diverticulosis and of diverticulitis was the detection of the diverticula themselves (LeWald, Carman, Case). The second important advance in the roentgen study of this condition was initiated by George and Leonard[16] who in March, 1919, called attention to an appearance of the colon which they considered almost pathognomonic of chronic diverticulitis, even though the roentgenogram might

not show diverticula themselves. They said:

Particularly along the descending colon and sigmoid one occasionally finds a peculiar serrated appearance. This may extend over several inches of gut and is associated with more or less narrowing of the lumen. These serrations are small, close together, and with a rather sharp point, presenting at times a sawtooth appearance . . . Repeated examinations given on different days show this appearance to be constant . . . The serrations do not change in size or shape. Furthermore, palpation under the fluoroscopic screen usually shows us that the intestine is more or less like a rigid tube . . . One infers that the serrated appearance is due to inflammatory thickening and induration of and about the intestinal wall, secondary to the presence of diverticula, the diverticula themselves not being visible.

This sounds very similar to the "prediverticular" state described by Spriggs and Marxer.[10] According to the latter, the normal segmentation of the bowel is absent, being replaced by a ragged outline of little convex irregularities, often seen along one side of the bowel only and sometimes confined to one haustrum only. In nearly all cases it is possible to detect at the same time both the prediverticular state and small diverticula in one part or another of the colon. A new fact brought out by Spriggs and Marxer is that this stage precedes the formation of the pouches and apparently is associated with some weakening of the submucosa and of the muscular layers. It is while the prediverticular state is in evidence that the minute herniae which subsequently form diverticula are pushed between the muscle fibers. Following this appearance of the prediverticular state there is often observed a stage of irritation causing a larger concertina-like appearance, sometimes giving to the colon shadow contours closely resembling the shadow of small intestine when slightly distended. This is followed by the fully developed diverticula of various sizes and shapes, many of them, even large ones, being made up of all the coats of the bowel as

proven by the fact that they can be observed to contract.

The exact shape of the diverticular shadow obtained with the opaque meal or enema depends upon the diameter of the orifice of the diverticula. If the orifice is wide enough, the diverticulum does not retain its non-opaque contents and the opaque material has no difficulty in entering the whole of the diverticulum and filling it, giving a perfectly rounded or ovoid shadow. In a diverticulum with a narrow orifice, however, the opaque meal does not displace the former non-opaque content but fills only the proximal portion of the pouch lying next to the lumen of the bowel, thus giving rise to a very characteristic crescentic opaque shadow. Occasionally one sees long finger-like diverticula closely resembling the vermiform appendix, sometimes shaped like an Indian club, extending between the folds of the mesocolon. It is quite possible that in acute diverticulitis in certain areas, the orifices of the diverticula may be completely obstructed so that it may be impossible to fill them by the enema or by the opaque meal, but elsewhere in the same colon it should always be possible to demonstrate the diverticula or diverticulitis.

As the third important step in the development of the roentgen-ray study of diverticula, the writer offers still a new observation. At a certain stage in each opaque meal examination, toward the end of gastric clearance, one sees the small intestinal loops well visualized. Naturally the ileac coils occupy the true pelvis, the jejunal coils lying higher in the abdomen, and toward the left the terminal coil of ileum is noted reaching up out of the true pelvis toward the ileocecal junction on the right side. When there exist fibroids, ovarian cysts and other pelvic tumors, pathological and physiological, the small intestine is lifted out of the true pelvis higher up into the abdomen. We have observed for years a similar roentgen-ray appearance in certain cases of divertic-

ulitis of the sigmoid; several hours before this part of the colon has been visualized, one notes a displacement of the small intestinal coils upward and toward the right. The normal undistended colon is easily compressible; when distended by gas, the gas is clearly observable, or, if filled by non-opaque fecal matter, this can be determined by a cleansing enema. But with these possibilities ruled out the amount of displacement is such that one can suspect a fat-laden sigmoid covered with swollen and edematous or inflamed epiploic appendages, the total forming a mass of considerable proportions. The idea that this finding (displacement of the small intestine upward and toward the right away from the left iliac fossa) may be due to the diverticula-laden sigmoid with marked peridiverticular manifestations, is strengthened in some cases by carefully noting the gas content of the area of sigmoid under suspicion, as in Figure 1. Here one sees clearly the gas content of the sigmoid, a row of small gas collections nowhere exceeding ½ in. in diameter (indicated by arrows), and yet the vacant space in the left iliac region due to the displacement of the small intestine is at least 3 in. in diameter. It is manifest that the difference between the 3 in. of vacant space and the ½ in. of colonic lumen represents the mass made up of the fat-laden, enlarged epiploic appendages attached to the already thickened walls of the colon.

For the meal we prefer barium sulphate in buttermilk (formerly we used bismuth subcarbonate). This has been our standard opaque meal for twenty years. For the opaque enema we employ barium sulphate in warm buttermilk or in a gum suspension.*

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* The writer's formula is as follows: To 2½ dr. of gum tragacanth, add about 1 oz. of alcohol. Shake well. Add 20 oz. of warm water and shake. Add 3 oz. of barium sulphate, then 20 oz. of water, shaking well each time. This mixture should be made up fresh shortly before using.

Ordinary buttermilk or mineral oil (Paralax, Petrol-agar, etc.), warmed to the temperature of 100°F., serves very well as a vehicle for the suspension of the barium for enema purposes. This latter preparation has the advantage of being quickly made ready.
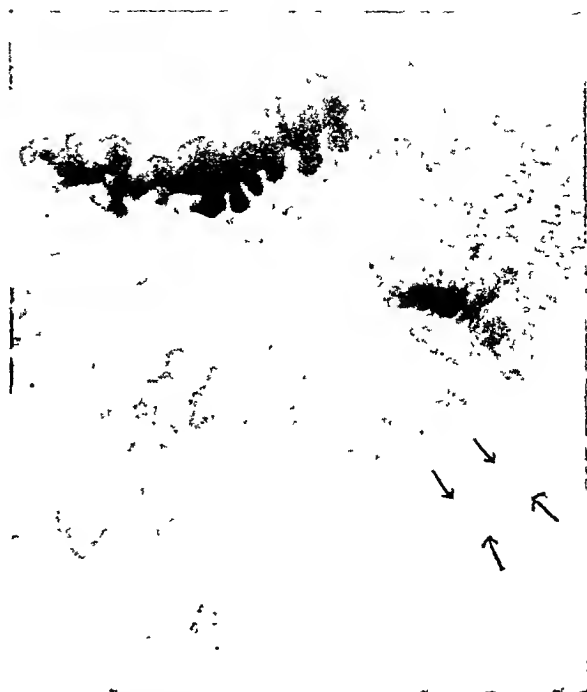
Fig. 1. Roentgenogram made four and one-half hours after an opaque meal, showing displacement of small intestine away from inguinal region to a much greater extent than usual—a new sign of sigmoidal diverticulitis. Case 1. Illustration retouched slightly to emphasize gas areas.

Exquisite pains should be taken with the roentgenographic technique in order to obtain every bit of fine detail. An accurate study of diverticulitis cannot be made except with first class roentgenograms.

When one detects in the pelvic colon a filling-defect with a localized narrowing of the lumen of the bowel, carcinoma rather than diverticulitis is naturally suggested, but it must be remembered that diverticulitis may coexist with carcinoma and that either condition may precede the other. At any rate, a coexistence of carcinoma with diverticulitis occurred in about 15 per cent of the Mayo Clinic cases. Max Ballin[17] believes that carcinoma arising in a diverticulum has certain characteristics in that it does not often grow toward or encroach upon the lumen of the bowel, and, therefore, a filling defect may not be apparent in the roentgenogram. Telling thinks it likely that carcinoma can cause diverticula and he is certain that diverticula may be followed by carcinoma formation; this leads him to state the following very important axiom:

No case of supposed carcinoma of the lower bowel must in future be regarded as inoperable either before or at laparotomy unless diverticulitis has been remembered, fully considered and systematically investigated.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis involves especially sigmoiditis, hyperplastic tuberculosis, carcinoma, actinomycosis, syphilis, left-sided (true, transposed) appendicitis, and certain pelvic conditions. Sigmoiditis is an older disease which may have a special dysenteric or local bacterial origin. It is probable that most of the reported cases of sigmoiditis were cases of diverticulitis. Some cases of sigmoiditis occur at earlier ages; the greater portion of them end in spontaneous recovery. There is more frequently an involvement of the mucosa. Syphilis is rare in the sigmoid; anyhow there are other evidences of lues which can be brought out in any suspected case. Actinomycosis usually occurs in the cecum, and the clinical and pathological developments are very much different than in diverticulitis. Hyperplastic tuberculosis is rare in the sigmoid although it does occur. Mailer[18] reports two cases in which there was operatively proved a coexistence of diverticulitis and tuberculosis of the sigmoid. Pelvic lesions are usually left sided, but the bimanual examination and the history usually permit a differentiation. In making studies of gynecological cases it is well always to keep in mind a possible diverticular lesion. Differentiation must also be made between diverticulitis and fecal impaction, encysted foreign bodies, chronic abscess, fistula and vesical tumor.

The most important lesion to be differentiated is sigmoidal carcinoma. In carcinoma of the pelvic colon loss of flesh occurs early. The painful symptoms do not develop until late. The formation of a tumor usually precedes the development of pain and tenderness. The sigmoidoscope is usually of little use in differentiation. Telling says the diverticular orifices seldom or never ooze pus. Indeed, it is difficult to understand how the sigmoidoscope can give much aid when we realize how hard it is to locate the diverticular orifices with the removed segment of bowel in the hand. When the sigmoidoscopic examination is negative the evidence is somewhat against carcinoma and in favor of diverticulitis.

TREATMENT

Prophylaxis. Careful education of the colon (establishment of the habit of regular spontaneous evacuation) and the practice of hygienic measures tending to improve the intestinal flora are prophylactic means of undoubted value in combatting the development of diverticula and the mutation from a diverticulosis to a diverticulitis. Increased intracolonic pressure unquestionably plays an important part in the development of sacculations and, when combined with increased sepsis of the contents of the colon, tends to produce the condition known as diverticulitis. An increased intracolonic pressure is encouraged by an attempt to resist the desire to empty the bowels, by straining at stool, and by acquiring the enema habit, especially the use of large enemas which produce markedly increased intracolonic pressure.

Diverticulosis is a common condition and calls for no other treatment than prophylaxis by ordinary attention to colon hygiene.

As for diverticulitis, it is important for surgeons to recognize that there is a *medical treatment.* While the disease is still confined to the colonic wall, it is possible to keep most patients in good health if they will adhere to the hygienic scheme below outlined. When the secondary inflammatory manifestations have occurred, then operation should be seriously considered, but even when a tender inflammatory mass can be palpated the lesion can often be made to subside by non-surgical management. However, such a case should be kept under close scrutiny until the danger of perforation or of abscess formation has been safely passed.

The hygienic scheme alluded to above

means careful attention to the general habits of the patient, avoidance of over-work, regularity in meals, discontinuance of smoking, the use of an abundance of paraffin so that the patient really leads a "paraffin life." A simple lactovegetarian diet with careful attention to regulation of the colon is a splendid prophylactic. The diet should be supplemented by plenty of lactose, or lactodextrine. Irrigation of the bowel should be practiced daily with saline solution, or, better yet, malt sugar or lactodextrine enemas at low pressure. Abdominal massage may be dangerous in these cases, especially when given over the diverticulum-bearing area of the bowel. Violent or irritating treatment may quite possibly reactivate a quiescent lesion, resulting in pain and even danger to the patient.

If the condition is acute, malt sugar or glucose enemas should be employed under low pressure; in some cases, warm olive oil in the quantity of 4 or 5 ounces may be preferable. It is important to abandon all purgatives for they are not only irritating but they may be even dangerous. On the other hand, antispasmodics are distinctly indicated, especially belladonna or atropine. In most instances of acute diverticulitis, the symptoms may be allayed within a few days by such treatment and even a tumor may be made to disappear.

Warnings have been voiced against the use of fruits containing small seeds, such as figs, currants, strawberries, raspberries and gooseberries. These warnings do not apply to foods producing bulky residues. Such foods as graham, whole wheat or bran breads, oat meal porridge and vegetables are probably better, provided the bowels are moved at least twice daily. Paraffin oil should be given in as large quantity as the patient can tolerate. Later on the paraffin may be diminished.

The writer in his original paper on the subject of diverticula advised daily doses of bismuth subcarbonate as a prophylactic. Moynihan mentions that very large doses of bismuth may be usefully administered from time to time in the hope of subduing infection.

Surgical Treatment. Operative interference should be elected as a means of treatment only in severe cases. A wide range of opinion exists regarding the preferable mode of surgical treatment. Some authors believe that the inflammatory sequelae of diverticulitis may be relieved medically. Others are of the opinion that the treatment should be conservative, but that when abscess does occur it should be treated as an abscess anywhere else in the abdominal cavity. Erdman believes that the acute type of diverticulitis demands drainage or removal as does a diseased appendix. Rogers states that he recognizes the possibilities of an acutely inflamed diverticulum and that his judgment would lead him to operate as soon as the diagnosis was sufficiently certain to justify surgical intervention.

In cases of diverticulitis (which refers to diverticula giving rise to symptoms), because of the potentiality for trouble, it should be a principle of surgery to remove the diverticulum-bearing gut when practicable. With obstruction relief is required and resection is the operation of choice, but if this is not possible one may have to do a colostomy or an exclusion operation. In the latter event it may be possible to do resection later, depending on the age and the condition of the patient. Sometimes a Mikulicz multiple-stage operation is applicable when the adhesions of the affected segment of the sigmoid can be freed. However, in practice it is seldom possible to resect the mass because of the dense adhesions surrounding it. Indeed it is questionable whether it is wise to even attempt to separate these adhesions unless a careful survey makes it quite evident that a resection will be possible. The adhesions are not only very dense but they are septic foci which if disturbed may result in acute peritonitis. In the majority of cases it is not wise to attempt a resection of the affected segment. In the average

case a colostomy above the obstruction or an exclusion operation is the procedure of choice. Even when there exists a perforation of the bladder, a preliminary colostomy is preferable; the resection may be done later. As above remarked, in cases associated with marked tumor formation these inflammatory masses may disappear in a short time when a colostomy is made proximal to the tumor. This has occurred even in cases with multiple tumors. If an external fistula is made, it must be kept open a sufficiently long time or the tumor will recur. The writer much prefers to make an internal fistula, short-circuiting the tumor, rather than a colostomy when the tumor is irremovable.

Mummery[19] suggests another surgical possibility, namely, to free the damaged portion of the bowel as much as possible and then wrap it with omentum. It may be possible to remove the more prominent diverticula and perhaps to carefully separate a number of adhesions. This wrapping with omentum is intended to prevent the inflamed sigmoid from again becoming adherent directly to the bladder or to the small intestine. This procedure may occasionally save patients from a permanent colostomy but the operative mortality is fairly high for infection is a serious consideration. For that reason, here, even more than with carcinoma of the colon, a preliminary temporary colostomy will tend to reduce the mortality.

Gerzowitsch[20] in 1925 reviewed 316 cases of operation for diverticula of the large bowel. In 85 cases of operation done for abscess and peritonitis, 50 per cent of cures resulted. In 44 operations for intestinal stenosis, 21 were treated by resection with one death, seven by colostomy with one death, five by enterostomy with two deaths and eleven by some operative procedure not specified. In five cases of colitis of very severe type, especially with hemorrhage, operation resulted in five cures (type of surgical procedure not specified). Finally in a last group of 182 cases where the type of operative proce-

dure was not clear, the immediate result was published in 51, resulting in 44 cures, seven deaths. In 131 cases the reporter failed to give an account of the operative details. Selecting from the 316 cases the ones giving sufficient details for tabulation, it is possible to make the following graphic presentation:

	Cases	Recoveries	Deaths	Results not specified
Resections.........	104	54	7	43
Colostomies........	8	7	1	0
Enteroanastomosis..	6	2	2	2
	118	63	10	45

According to the known results in the resection cases (54 recoveries and 7 deaths), the percentage of recovery was 87. Only a few late results were given in the above series; in ten cases the patients were found to be perfectly well from four to eleven years after operation.

Persistent attacks of pain and tenderness in spite of careful medical prophylaxis, signs of threatened obstruction, a palpable tumor of the colon, frequent and painful urination with attacks of pain in the left iliac region and symptoms of an abscess or peritonitis, are definite indications for surgical treatment of diverticula. Perforation and abscess or localized peritonitis demand prompt transfer to the surgical service. Simple drainage will often suffice in such a case without ever forgetting that the cause of the trouble is not modified by such symptomatic management. Persistent tumefaction or obstruction demands exploration or resection because of the danger of malignancy, though sometimes a colostomy will prove to be the only treatment feasible.

A few typical cases will be reported illustrating the various principles of diagnosis and treatment above set forth.

CASE REPORTS

CASE I. Cecal Diverticulitis; Resection of Diverticulum.
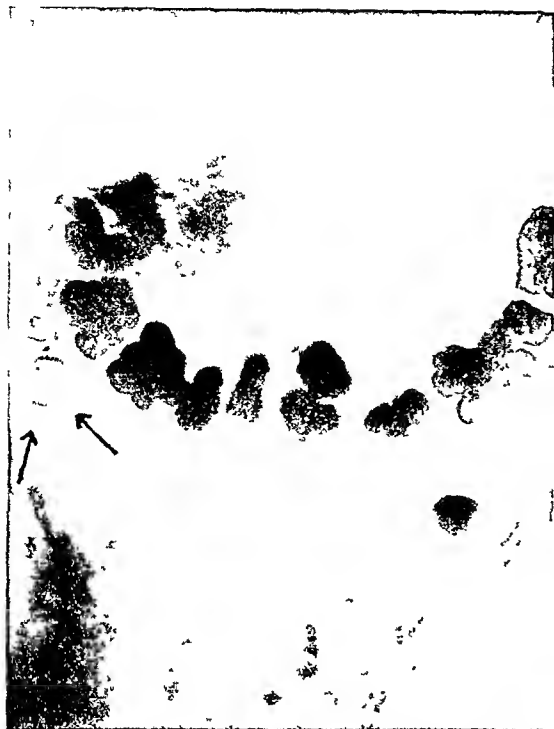
FIG. 2. Diverticulum of the cecum (at arrows) twenty-six hours after the opaque meal. Case 1.

FIG. 3. Diverticulum of cecum, fifty hours p. c. Case II.

White female, aged forty-seven, admitted December 27, 1923, complaining principally of a chronic lower abdominal pain which had persisted in spite of operation for removal of the gall bladder and the appendix four months ago. The pain came whenever she ate, appearing a few hours after the meal, described as a terrible burning pain across the lower abdomen, preventing sleep. For the previous two weeks the pain had been much more severe, mostly localized about the cecum but radiating toward the middle of the lower abdomen. In addition to some minor troubles, the roentgen-ray study showed a condition of colonic diverticulosis, with one especially large, poorly drained diverticulum of the cecum (Figs. 2 and 3). The patient returned to her home for operation by the same surgeon who had previously removed the appendix. He operated again six months after his first operation, removing a diverticulum measuring 2.5 by 3.5 cm., containing a concretion almost as hard as rock entirely filling the sac. The symptoms have not recurred.

CASE II. Diverticulosis of Transverse Colon; Prophylactic Diverticulectomy; Cholecystectomy; Division of Constricting Pericolic Membranes of Ascending Colon.

White female, aged fifty-seven, admitted December 14, 1922, complaining chiefly of pain and burning between the shoulders and especially pain in the top of the right shoulder, acid eructations and sometimes a burning pain in the back and hip on the left side. Several years before, appendectomy was done for chronic appendicitis. Several gastrointestinal upsets had occurred within the last three years for which she was under the care of a stomach specialist. Recently she had noted an increase of abdominal pain after dietetic indiscretions. Constipation had existed for years, for relief of which she had taken much laxative medication, chiefly calomel. There were inflamed and bleeding hemorrhoids.

Examination resulted in the following findings: normal gastric report, clinically, chemically and roentgenologically; chronic cholecystitis, probably non-calculous; cecal dilatation with stasis in proximal colon; several small diverticula of transverse colon (probably intramesocolic); hemorrhoids; congenital multiple exostoses.

On December 28, 1922, the patient submitted to operation for removal of the gall bladder because of chronic cholecystitis and marked pericholecystitis without stone, division of a parietocolic band along the ascending colon,

FIG. 4. Enema-filled colon showing two intramesocolic diverticula (at arrows).
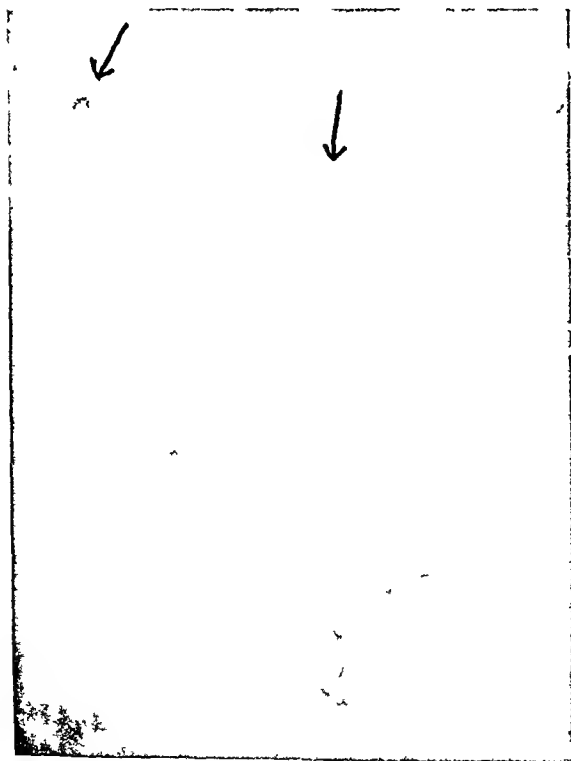
FIG. 5. Same case as Figure 4, shown after evacuation of most of opaque clysma. Diverticula more clearly shown. Case II.

FIG. 6. Sketch made at operating table illustrating the location of the larger diverticulum of Figures 4 and 5. Case III.

and prophylactic resection and inversion of the stump of the larger of the two diverticula found, as shown in the roentgenogram (Figs. 4 and 5). There were no adhesions or other sign of inflammatory reaction about the diverticula but since the larger one lying to the left of the middle of the transverse colon contained a hard stercolith which was expressed with some difficulty, its removal was deemed a wise prophylactic procedure. The diverticulum lay between the folds of the transverse mesocolon, measuring about 2 cm. in diameter, with an orifice half that size. Several small blood vessels passed along the peritoneal covering of the diverticulum but two conspicuously larger vessels passed one on either side of the sac into the colon, as illustrated in Figure 6. The patient made a normal recovery and was able to report satisfactory improvement a year later.

There was no reason to anticipate any improvement attributable to the diverticulosis; the operation was done as a purely prophylactic measure, made possible by the necessity of operative interference for cholecystitis and cecal stasis.

CASE III. Large Diverticula Limited to Transverse Colon; Diverticulitis; Resection and Immediate Anastomosis.
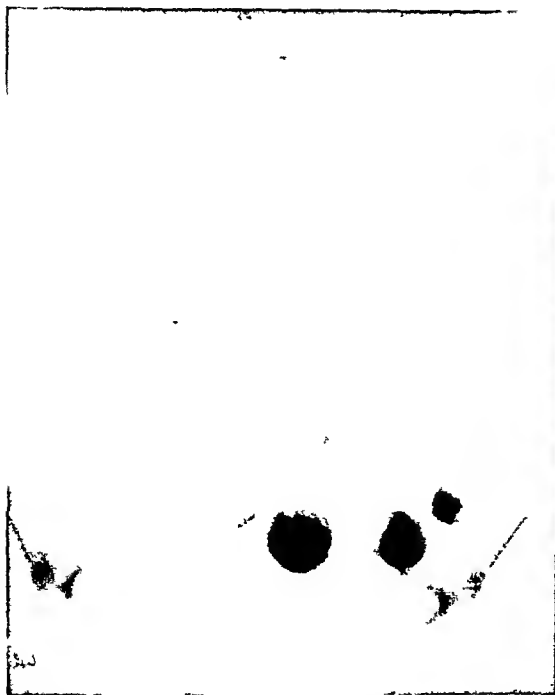
FIG. 7. Large antimesocolic diverticula of transverse colon, shown fifty hours after opaque meal, the remainder of barium having been evacuated. See Figures 8 and 9.

FIG. 8. The diverticula of the transverse colon shown in Figure 7, seen in relation to the enema-filled colon. See Figure 9. Case III.

FIG. 9. Photograph made during operation on transverse colon diverticula of Case III. See Figures 7 and 8.

White female, aged forty-eight, admitted August 13, 1923. Family history negative for any lesions simulating diverticulitis. The patient was never very strong but she had suffered from considerable diarrhea at times, coming in attacks of short duration. For the previous two and a half years the patient had complained of severe headaches, periods of hyperacidity, symptoms suggestive of cystitis, constipation interrupted occasionally by short attacks of diarrhea, spells of abdominal pain with distention, so that abdomen became hard and tense. No mucus or blood noted in the stools. Increasing arterial tension during the last two years (on admission 135/90). Abdominal examination revealed a full, tense cecum

FIG. 12. Photomicrograph of one of the diverticula of Case III.

FIG. 10. (Case III) Photograph of hardened specimen of transverse colon diverticula, unopened. See Figures 8 and 9.

FIG. 11. (Case III) Operative specimen of transverse colon diverticula, hardened specimen, opened.

with some tenderness on palpation over the midabdomen. Blood picture normal; leucocytes 7,500 to 8,700. Because of certain food relief of hyperacidity and previous suggestions from examining physicians, the patient was put through a barium meal study with results shown in Figures 7 and 8. Figure 7 shows four large diverticula of the transverse colon, the larger of which retained barium content in much greater density than the others. The diverticula measured, in shadow, from 2.5 to 4.0 cm. in diameter, and are shown here fifty hours after the opaque meal, persisting in spite of cleansing enemas given in preparation for the opaque injection, illustrated in Figure 8. There was a normal duodenal bulb. Subsequent observations showed the diverticula still filled with barium on the fourteenth day.

Operation September 3, 1923. Under nitrous oxide-oxygen anesthesia, the transverse colon was exposed and the diverticula easily located by palpation and inspection on the antimesenteric border of the colon midway between the attachments of the mesocolon and the great omentum (Fig. 9). About 20 cm. of the transverse colon containing the diverticula was resected, carefully preserving the great omentum. Continuity of the bowel was at once restored by end-to-end anastomosis, and some omentum wrapped around the junction.

Immediately after terminating the operation, the writer made the following observations:

The proximal pouch joined the bowel by an opening, measuring less than 1 cm. in diameter, surrounded by a definite hard ring; in none of the other sacculations was this ring to be felt. The largest pouch measured 4.5 cm. in diameter and its orifice 2.0 cm. The two proximal pouches were filled with hard material, expressed with great difficulty. The content of the second, the largest, pouch consisted of very hard, dry material, including barium given fifteen days before the operation, carmine in laminated streaks, bran, and dried out fecal matter. The external appearance of this diverticulum in the fresh specimen suggested the aspect of a Meckel's diverticulum which had undergone repeated inflammatory crises.

Pathological report (by A. S. Warthin): The hardened section of colon removed measured 18 cm. in length (Fig. 10). On its free margin it presents a series of five[*] saccular dilatations and one smaller, imperfectly developed, shallow diverticulum between the second and fourth from the proximal end. The largest sac measured 3.5 cm. in diameter, the smallest 1.5 cm. The saccular diverticula are almost spheric. The peritoneum over these appears normal. There are no local adhesions, and no evidence of local peritonitis.

Viewed from the lumen of the intestine

[*] Roentgen-ray study as well as inspection at the operation and immediately after clearly showed only four large sacculations which had any tendency to retain their contents. The pathologist describes six diverticula in the hardened specimen. Comparison of the roentgenograms with the photographs suggests that there is a definite relation between enlarging haustra and diverticula.

(Fig. 11), these diverticula show mouths varying in diameter from 6 mm. to 2 cm. The uppermost and the lowermost have narrower constricted openings. The six diverticula lie close together. The lower three are separated by partitions only 4 mm. in thickness. The largest one, next to the uppermost, is separated from its neighbors by a broader area of mucosa, about 1.5 cm. These saccular diverticula are all lined by mucosa containing lymph follicles. They appear to the naked eye to consist of mucosa and serosa only; the muscle coats appear to be lacking. Between the second and the third diverticula there is an imperfectly developed pouch about 4 mm. deep. The wall of this is less translucent and contains unstriped muscle.

There are no gross pathological changes apparent in the walls of the sacs. The constricted mouth of the uppermost one shows slight radial constriction of the mucosa about the mouth but no other pathological appearance. Transverse section of the uppermost one was taken for microscopical study (Fig. 12).

On microscopic section the wall of the saccular dilatation is seen to consist of mucosa, muscularis mucosa, submucosa and muscle coats, the external muscle coat being relatively poorly developed but in patches showing some hypertrophy and new formation of unstriped muscle fibers. There is a gradual decrease in both coats toward the center of the sac but the disappearance is particularly marked in the inner coat, both coats becoming reduced to very narrow bands containing only a few fibers. The smaller blood vessels show thickened walls in this area of greatest muscular atrophy and there are small areas of inflammatory infiltration scattered through the subserosa. These infiltrations are most marked at the borders of the saccular dilatation at the point where the atrophy of the muscle coats begins to be most marked. The mucosa of the colon shows everywhere a chronic catarrh, moderate atrophy, numerous eosinophiles in the interstitial tissue and numerous pigmented phagocytes. The eosinophiles are eosinophilic plasma cells, Russell Plimmer bodies.

The lymph nodes are all atrophic. The mucosa over the saccular dilatation is well preserved, showing only a little atrophy. These saccular dilatations are of the acquired type, a gradual stretching of the wall with atrophy of the muscularis. The partitions between the

openings into the diverticula are formed by the semilunar folds. The diverticula, therefore, represent dilatations of the intestinal wall between these folds.

The patient reported one and five years later, recording a gain in weight of ten pounds more than ever before in her life, freedom from the abdominal attacks of pain and distention, absence of digestive complaints, and general renewal of health.

Case iv. Diverticulitis of Transverse Colon and of Sigmoid, with Multiple Tumor; Cecosigmoidostomy.

White male, aged seventy-five, admitted May 28, 1925, complaining of pain and aching in the upper abdomen. A previous examination at the Battle Creek Sanitarium in 1917 resulted in a diagnosis of multiple diverticula of the colon (Fig. 13), the sacculations being distributed pretty much throughout the colon but rather more numerous in the upper part of the pelvic loop. There were also diverticula in the duodenum. At that time he was accompanied by his brother who proved to have a similar condition of extensive diverticulosis. In December of the following year a cholecystectomy was done for an acute gangrenous cholecystitis and it was hoped that this would relieve the upper abdominal pain which had disturbed him for some years. When the upper abdominal distress continued, the question arose as to how much of it might be due to the adhesions which surely followed such a gall-bladder condition. There was a constant feeling of tenderness and pressure in the left lower as well as across the upper abdomen, with frequent bowel movements and much gas distention. Repeated stool examination showed no more than an occasional trace of blood, and this was attributed to the hemorrhoids reported by the proctologist. About May 1, 1925, the patient's symptoms became urgent. One morning about 2 o'clock, he was awakened by pain in the upper abdomen; since then he had been having more or less pain across the epigastrium apparently not related to meals. No regularity as to time of appearance or duration. Paregoric was employed for relief. Bowels badly constipated. Unable to take enemas because of pain; could take only a small injection, which he had to expel immediately and with force.

Examination showed a definite resistance in the epigastrium and under the left costal margin which, when palpated under the fluor-
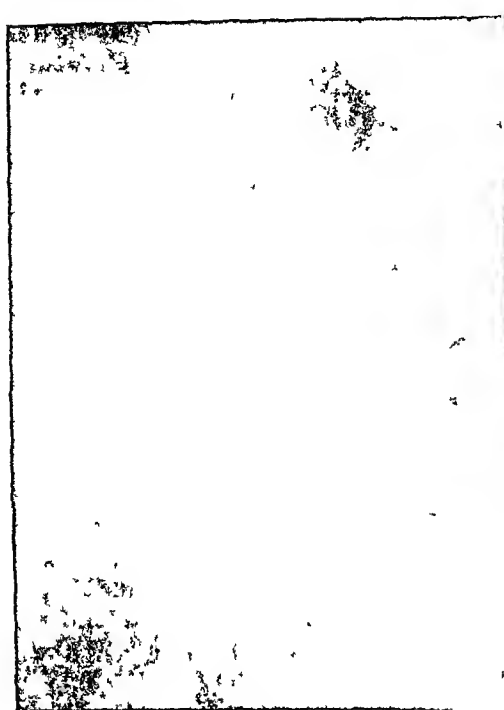
FIG. 13. (Case IV) Roentgenogram made eight years before admission. Fifty hours p. c. Multiple diverticula of entire colon, especially marked in transverse descending colon and sigmoid.

FIG. 14. Same case as Figure 13 (Case IV), colon filled by opaque enema after recovery from operation for cecosigmoidostomy. Note transverse colon of normal caliber, filling defect and palpable tumor having disappeared.

oscopic screen, coincided definitely with the transverse colon visualized by the opaque enema. On account of the acuteness of the symptoms and the elevated white cell count (12,900), the patient was given medical attention as outlined in the body of this paper, but in spite of all effort the symptoms of obstruction grew steadily worse and a definite left subcostal tumor became palpable. The question of carcinoma arose. Because of the patient's age, long history, and the narrow zone of filling-defect in the colon shadow, although only a trace of blood was noted in the stool, carcinoma was definitely suspected and some form of exclusion operation recommended.

Operation June 13, 1925, under lumbar anesthesia. The transverse colon was held high by adhesions of the omentum in the gall-bladder region which made it impossible to examine the liver. The descending colon and the upper half of the sigmoid was a mass of diverticula with definite tumefaction. A few scattered sacculations were made out in the cecum and in the lower half of the sigmoid, but there was no induration in this part of the bowel. The left half of the transverse colon was the seat of a large, very hard mass which

seemed definitely malignant rather than inflammatory. It was not adherent to the abdominal wall and it moved up and down on respiration. There were numerous adhesions of the cecum but none of the small bowel. The cecum and the lower half of the sigmoid were sufficiently freed of adhesions to be approximated, after which a cecosigmoidostomy was done with a Jaboulay button. The convalescent period was less stormy than had been anticipated. The button passed on the forty-seventh day. The tumor in the left hypochondrium gradually diminished in size and finally disappeared. Examination of the colon by opaque enema on the fiftieth day demonstrated normal caliber of the transverse colon (Fig. 14) where previously a definite filling-defect was plainly to be seen. The patient, a physician, resumed his practice. Nearly three years later he is reported as continuing in good health, free from any symptoms of diverticulitis.

A possible hereditary transmission of a tendency to diverticula formation has been suggested by MacKoy[21] who reported eight members of a family in three genera-

tions who suffered from a chronic intestinal trouble that presented similar clinical pictures in all cases. The brother of the case just described (Case IV) is another example of an apparent familial tendency.

CASE V. Epiploitis (Acute Diverticulitis?) of the Sigmoid.

White woman, aged forty-nine, was seen as an emergency April 21, 1920, suffering with pain in the left inguinal region; she was decidedly nauseated and vomited frequently. She had a sudden attack of severe pain about 2:30 A.M. of the 20th, requiring hypodermics for relief. Temperature, not abnormal; pulse, 84. No abdominal distention. Some carefully administered warm enemas were evacuated without difficulty. About 8:00 o'clock there was a recurrence of the pain and the vomiting, tenderness being most marked along the descending colon and sigmoid. Blood count: hemoglobin 83 per cent; red cells, 3,700,000; white cells, 22,500; polymorphonuclears predominating. The following morning the attending physician ordered a roentgen-ray study of the urinary tract which showed no abnormalities. Roentgen-ray study of the colon by enema showed adhesions and marked spasticity of the pelvic loop but no definite diverticula. Carcinoma was suspected, with an acute obstruction supervening.

Immediate operation was performed. The proximal colon and the small intestine were tensely distended but no mass could be palpated anywhere in the colon. In the pelvic loop there was found a mass lying between the folds of the mesocolon at a point about 8 in. above the peritoneal reflexion and some adhesions of the pelvic loop to the left tube and ovary. One of the epiploic appendages which was inflamed was removed as one would remove an appendix. The appendix vermiformis was examined and found free from any acute inflammation although it shared in the general turgescence of the entire colon. In view of the high white cell count a tube drain was placed in the left iliac fossa. The patient made an uneventful recovery leaving the hospital for home on the seventeenth day.

Pathological report (by A. S. Warthin): Congested, inflamed epiploic appendage. No trace of diverticulum in the specimen examined.

In two other cases of this type which have come to operation in our service,

FIG. 15. (Case VI) Colonic diverticula especially numerous in iliac and pelvic colon, with signs of peridiverticulitis.

diverticula have been identified in the epiploic appendage; but in this case no diverticulum was found. We believe this type of epiploitis has a diverticular origin. Further possible doubt on the diverticular origin of this case is cast by the fact that the roentgen ray failed to demonstrate diverticula.

CASE VI. Acute Diverticulitis of Sigmoid; Cecostomy; Death from Mesenteric Thrombosis.

White male, aged fifty, admitted February 20, 1920, suffering from indigestion, constipation, right upper quadrant pain and insomnia. Five years before a gallstone had been removed by cholecystostomy. His stool examinations showed no blood. Proctoscopic study showed marked spasticity at the rectopelvic junction and marked rectal constipation. Medical treatment directed toward the constipation gave the patient considerable relief and he returned home March 1st. On May 13th, he returned to the Sanitarium with symptoms of an entirely different character—frequent stools with blood and mucus during the last ten days, progressive loss of weight and strength, severe pain in the region of the coccyx. As many as fifteen bowel movements occurred daily, consisting

FIG. 16. (Case VII) A few diverticula retaining barium from opaque meal of three days previous, shown in relation to enema-filled colon. Extraordinarily few sacculations detected, considering the operative findings (see Figures 18 and 19).

FIG. 17. (Case VII) The same diverticula of Figure 16, after the patient has tried to evacuate opaque enema.

chiefly of mucus and blood. Hemorrhoids had developed. Roentgen-ray examination showed diverticulitis of the colon involving particularly the iliac and the upper portion of the pelvic loop (Fig. 15). On account of the acuteness of the situation, medical treatment was recommended to allay the irritation of the colon before taking the case to surgery.

The patient did not consent to surgery until July 27, 1920. At operation the colon was found to be the seat of numerous diverticula, most of them rather small. There were several areas of induration in the mesocolon. Under the circumstances of the case it was deemed wise to do a cecostomy instead of a resection. A colon tube was inserted through the rectum well up into the sigmoid and left in place. One epiploic appendage was removed for pathological study. There were so many adhesions in the right upper quadrant that the gall bladder could not be identified. There was a diverticulum of the bladder, 1½ in. in diameter and 2½ in. deep. This was inverted and sewed in place with a double row of sutures. The patient died

August 19th of a mesenteric thrombosis, demonstrated at autopsy.

The writer and many others have repeatedly referred to the frequent coexistence of diverticula elsewhere in cases of colonic diverticulosis. We have frequently demonstrated in the same patient sacculations in the bladder as well as in the colon and in other parts of the alimentary tract, and we have exhibited the records of one patient with diverticula of the esophagus, duodenum, small intestine, colon and urinary bladder. This constitutes a good reason for using the term "diverticulosis" in describing this condition, especially when there is no good reason to believe that secondary inflammatory states have arisen.

CASE VII. Diverticulitis of Sigmoid with Recurring Attacks Simulating "Left-Sided" Appendicitis; Resection; End-to-End Anastomosis.

White female, aged fifty-five, admitted November 30, 1922, complaining of general ill health, indigestion with hyperacidity, vague

Fig. 18. (Case vii) Gross appearance of operative specimen of diverticula-laden sigmoid.

joint symptoms, recurring attacks of lower abdominal pain associated with irritability of the bladder, abdominal distention, fever, nausea and occasionally vomiting. She denied constipation, saying that the bowels usually moved twice daily without cathartics, but repeated proctoscopic examination showed a large amount of residual feces with rectal stasis.

Examination resulted in the following abnormal findings: peridiverticulitis of sigmoid (Figs. 16 and 17) with recurrent acute attacks, moderate vascular hypertension, chronic maxillary sinus infection and internal hemorrhoids. The leucocytes numbered 6,600.

In view of the history of repeated acute attacks as above described and the discovery of the diverticula of the sigmoid, operation was recommended, but was declined by the patient. Indeed, the recommendation was not pushed for the reason that the diverticula were apparently rather few in number, confined to 4 or 5 inches of the pelvic colon and not associated with signs or symptoms of obstruction. True, one of the diverticula measured 1.2 cm. in diameter on the roentgenogram, and retained barium for many days. Advice was given as to prophylactic measures for home treatment and the patient left the office expecting to return home the following day.

During the night there occurred another of the acute attacks which constitute the most interesting feature of her history, the temperature reaching 101.2°F., and the leucocyte count 27,300. There was extreme lower abdominal pain, muscular rigidity and nausea, so that the patient decided to undergo operation as soon as it was feasible. Meanwhile medical treatment as indicated in the preceding pages was instituted.

The following additional important facts of history were elicited: At the age of twenty, she began to have intestinal colics, the beginning of which she attributed to an attack of "ptomaine poisoning." After this she experienced intermittent attacks of colic and intestinal distress which often came on during a meal, obliging her to stop eating. After that she had attacks of diarrhea every summer. It was discovered that she ran a low fever most of the time. The frequent attacks of intestinal indigestion continued with periods of freedom from symptoms. Sometimes the attacks came every other day for a week or more and then there would be an interval of quiescence for two or three months. She was not conscious of any abnormally high temperature. Several physicians thought she had tuberculosis of the intestines but could find nothing to support such a diagnosis except the high temperature.

About a week later (December 18, 1922) the pelvic colon was exposed and found to contain multiple diverticula. The secondary manifestations of diverticulitis were apparent; the pelvic colon was adherent in three places, the epiploic appendages were edematous and much enlarged, and the sigmoid for a distance of about 25 cm. seemed heavy and rope-like. Thirty cm. of sigmoid (Fig. 18) was removed down to within 3 cm. of the peritoneal reflection, and end-to-end anastomosis done over a tube. The patient left the hospital on January 22, 1923, after a fairly stormy convalescence, especially during the first five or six days.

The pathological report (by A. S. Warthin)
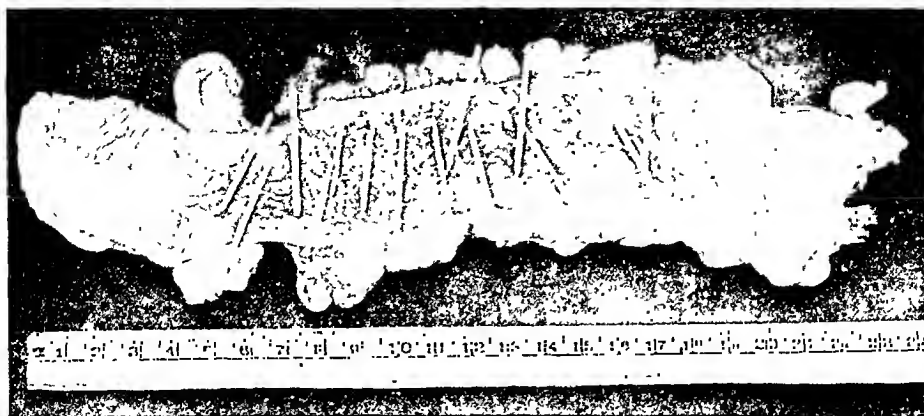
FIG. 19. (Case VII) The opened bowel, with matches inserted into larger diverticular orifices.

follows: Gross Pathology. Portion of intestine 30 cm. in length. The most important pathological· change externally is a marked overdevelopment of the epiploic appendages which show a very marked lipomatosis. Some of these have an elongated pedicle and a distinct appendix-like shape. They measure from 1.5 cm. to 3.5 cm. in length and from 1 to 2.5 cm. in breadth or in diameter.

The majority of these show the appearance of adipose tissue, light yellow in color, but others show marked congestion and are of a firmer consistency. The mucosa of the intestine shows multiple small openings into small diverticula which extend into the epiploic appendages.

FIG. 20. (Case VII) Photomicrograph of one of the sacs of the specimen shown in Figures 18 and 19, indicating that they are true diverticula.

The largest of these, fifteen in number (Fig. 19) are large enough to admit easily a toothpick. The diverticula vary in length, the longest one, extending into the largest epiploic appendix, being over 2 cm. in depth. The others measure about 1 cm.

The opening into these diverticula is crater-like with a small central opening. The mucosa about this opening appears perfectly normal and there is no evidence to the naked eye of erosion, ulceration or inflammatory reaction. Likewise the lining of the diverticula presents the appearance of the normal mucosa. No abnormal contents were found in these small diverticula. They were either empty or contained mucus. The epiploic appendix into which the largest diverticulum extends shows the most marked hyperemia.

The adipose tissue of the mesentery attached to the intestine shows hyperemia or hemorrhage.

Pathological Diagnosis. These are true diverticula (Fig. 20) with a projection of the mucosa through the muscle coats, the tip of the sac being covered only by the serosa, subserosa and muscularis mucosa, submucosa and mucosa, constituting a true protrusion of the mucosa through a defect in the muscularis. The sac is lined by an atrophic mucosa. The diverticula contain mucus and bluish-staining, granular material (barium?). There is no inflammatory reaction in the wall of the sac. In the mucosa of the diverticulum there is one large lymph node and one smaller one.

One year later the patient was examined by way of inventory with the finding of an annular rectal stricture, occurring at the site of the end-to-end anastomosis. She submitted to a series of dilations which finally gave relief. The general condition was very satisfactory. There had been observed no further elevation of temperature and no further diarrhea.

One cannot help remarking on the relative severity of the lesion in this case which seems quite out of proportion to what one would anticipate in consideration of the small number of diverticula visible in the roentgenogram. This teaches the lesson that the severity of a diverticular lesion cannot be judged from the number or size of the diverticula visualized in the roentgen-ray examination. Especially is this true in those cases with tumor formation. The tumor is due to the deposit of fibrous tissue around the diverticula and to the edema of the epiploic appendages. Very often there can be traced through these tumors narrow channels representing diverticula, channels of such narrow dimensions, scarcely admitting a small probe, that they rarely lead to cavities of any size.

A perusal of the report of the pathologist, who knew, of course, nothing of the history of the patient, would indicate a mild case, out of all proportion to the actual clinical behavior and the operative findings.

CASE VIII. Sigmoid Diverticulitis with Mimicry of Duodenal Ulcer; Rupture of Diverticulum; Emergency Operation (Simple Drainage); Cure.

White male, aged fifty-two, was admitted March 12, 1923, with a history of recurring duodenal ulcer, for which medical treatment had been twice given. For many years he had been having much gas distention. Four years before admission he began to experience abdominal pain sometimes relieved by eating and always relieved by soda, but he was relatively free from pain when resting. Laxatives had been used for constipation. On admission his pains were not controlled by food; the distress was fairly constant, and was made worse by exercise. Physical examination showed marked epigastric tenderness, especially over the gallbladder region. On account of numerous previous roentgen-ray studies, roentgenological study was ordered for the upper abdomen only. This showed an inconstant deformity of the duodenal bulb, no definite duodenal ulcer, and (a thing which was not noted until later) a curious displacement of the small intestine away from the left iliac fossa to a degree much more pronounced than usual (Fig. 21). A

FIG. 21. (Case VIII) Peculiar displacement of small intestine away from left inguinal region, due to unusually heavy, rope-like sigmoid, with edematous, fat-laden epiploic appendages, forming mass of considerable proportions.

diagnosis of duodenal ulcer was finally adopted and the patient once more put through the usual medical treatment for this condition. Because of the rather high grade of intestinal stasis, particular attention was paid to its treatment. About May 15th, the patient returned for a continuation of treatment for his intestinal stasis, planning to leave for home again in about a month. The evening before his intended departure, he had a final sigmoidoscopic examination at about 5:30; at about 6:30 while seated at table in the dining room he was seized with such sudden, excruciating abdominal pains that it was at once apparent a serious condition had developed. There were rigid abdominal muscles, nausea, vomiting, cold perspiration, pallor, and rapid pulse. After a brief delay consent was given for operation, which was done at about 10:00 P.M.

The operation (June 13, 1923) revealed multiple diverticula of the sigmoid with a perforation low down near the peritoneal reflection at the site of one of the diverticular sacs. The sigmoid was adherent to the bladder and to the left anterior abdominal wall by numerous attachments of the epiploic append-

FIG. 22. Irregular filling defect in sigmoid colon characteristic of carcinoma with numerous diverticula in vicinity. Carcinoma due to diverticulitis (?). Diverticulitis due to carcinoma (?). Associated lesions (?).

FIG. 23. (Case x) Characteristic roentgenologic appearance of diverticular tumor, extremely hard to differentiate from carcinoma of sigmoid.

ages. The adhesions were freed sufficiently to permit exteriorization of a part of the sigmoid loop in preparation for a possible colostomy, and a cigarette drain was placed in the depths of the true pelvis. Within a few days it became evident that a colostomy would not be necessary, so the exteriorized loop of sigmoid was allowed to drop back into the peritoneal cavity. In spite of a greatly prolonged convalescence, due to postoperative bronchopneumonia, final recovery was complete and no further symptoms have called attention to the diverticula. The patient was seen early in 1928, at which time cholecystography revealed a large gallstone which doubtless has been present for years and perhaps explains the "duodenal ulcer" for which he took medical treatment on various occasions.

CASE IX. Carcinoma of Sigmoid Apparently Superimposed on Diverticulitis; Resection of Sigmoidal Tumor Together with the Fundus of the Bladder.

White male, aged fifty-seven, admitted August 22, 1926, with a history of colitis, with mucus and slightly bloody stools, dating back about five months. The stools were formed and it had not been necessary to use laxatives. Unusual gas distention of the abdomen had been a troublesome symptom.

Roentgen-ray study confirmed the presence of a sigmoidal growth having the appearance characteristic of carcinoma, and in addition multiple diverticula of the colon, more numerous in the sigmoid in the vicinity of the filling-defect (Fig. 22). On account of the history a tentative diagnosis was made of carcinoma associated with diverticulitis, and operation recommended. The hemoglobin was 80; red cells, 4,500,000, and white cells, 5,100.

Operation October 1, 1926, revealed a normal liver, gall bladder, duodenum and stomach, and a fist-size tumor which had the external appearance of carcinoma, but accompanied by a number of diverticula, some of them showing inflammatory reaction about them. Hope was entertained that the tumor might prove to be inflammatory only. The fundus of the bladder was involved over an area of 20 or 25 sq. cm., necessitating resection of a portion of the bladder together with the sigmoidal tumor. About 20 cm. of sigmoid was removed, con-

tinuity of the bowel being restored by end-to-end anastomosis over a large rubber tube. Pathological report: advanced annular adenocarcinoma.

The patient made an excellent recovery and to date has had no symptoms referable to the intestine or bladder.

CASE X. Sigmoid Diverticulitis, with Tumor and Obstruction; Question of Carcinoma; Colostomy.

White male, aged sixty-seven, admitted March 21, 1928, suffering from soreness in the epigastrium, nausea but no vomiting, general weakness, loss of appetite, strength and weight, and nocturia with difficulty in starting urination. The present illness started four weeks before admission with chills, elevation of temperature and epigastric discomfort and pain. The patient insists that his previous health had been good; he never had any indigestion or constipation alternating with diarrhea, and had never observed blood in the stools. In view of the extreme upper abdominal distress, carcinoma of the pancreas or a gall-bladder lesion was suspected. A Graham test showed "absence of the gall-bladder shadow." A urethral stricture accounted for the urinary difficulty. Roentgenograms of the colon showed multiple diverticula with definite signs of diverticulitis in the sigmoid (Fig. 23). There was a definite filling defect and apparently a cavity about 2 cm. in diameter connected with the lumen of the sigmoid by a definite fistulous tract. Proctoscopic examination showed no sign of malignant growth and there was no visible or occult blood in the stool.

The abdominal symptoms were so strongly in favor of an upper abdominal lesion that we finally did an exploratory operation on the upper abdomen. The gall bladder was found buried in adhesions which bled very easily on separation. The common duct was finally found and explored but no stones were felt. The head of the pancreas was soft. Stomach and duodenum were normal except for adhesions. A tumor of considerable size was palpated in the sigmoid, but in view of the history, the definite proof of diverticulitis with the presence of an extensive rather than a localized filling defect and the negative sigmoidoscopic examination, it was concluded that the tumor was probably benign and due to diverticulitis. The gall bladder was removed, and fourteen days later, through a left inguinal incision,

the sigmoidal tumor was exposed with the hope of dealing with it by the technique of Mikulicz. On examination of the tumor more carefully under inspection and palpation, however, it was found to be so infiltrated and so very extensively adherent to the bladder in the region of the left ureter that we decided to do a colostomy in lieu of resection. Accordingly, a left inguinal colostomy was performed under the strong impression that the lesion was not malignant, believing that within a few months time the tumor would disappear. This patient has made an excellent operative recovery, but the case is too recent to judge the final outcome.

CONCLUSIONS

1. Emphasis is placed on diverticulitis as opposed to the relatively harmless condition of diverticulosis.

2. Cases of diverticulitis are classified as (a) enterospasm type, (b) hyperplastic type and (c) pseudoappendicitis type.

3. Outstanding symptoms are detailed and special attention called to the mimicry of carcinoma of the colon, appendicitis, gall-bladder disease and even duodenal ulcer.

4. Roentgenological study supplies the decisive proof of the existence of diverticula and furnishes many signs indicating the transition from the stage of diverticulosis to the stage of diverticulitis. There are three roentgenographic signs of diverticulitis: (a) the small rounded shadows due to the retention of opaque material in the diverticula (LeWald, Carman, Case); (b) the signs of the prediverticular stage (George and Leonard, Spriggs and Marxer), and (c) the characteristic displacement of small intestine loops away from the left iliac fossa by the fat-laden, epiploic appendages producing a rope-like sigmoidal mass (Case).

5. Prophylactic measures are urged and carefully detailed, with the idea that one can definitely deter the transition from the harmless condition of diverticulosis to the dangerous condition of diverticulitis.

6. Medical treatment is appropriate and preferable to surgery in a large group

of cases, and as a preparatory measure in many cases in which surgery is sure to be ultimately needed. Diet is discussed.

7. Surgery is indicated as the treatment of choice only in severe cases. Because of the potentiality for trouble the diverticula-bearing gut should be resected when practicable, but if it is not possible to resect, the indication is for a colostomy or for an exclusion operation. Reference is made to Mummery's suggestion to wrap the diverticular area with omentum. In tumor cases simple colostomy often leads to disappearance of the inflammatory mass. In abscess cases or when the epiploic appendices are acutely inflamed, simple drainage is indicated.

8. Ten detailed case reports with illustrations illuminate the points brought out in reference to diagnosis and treatment of colonic diverticulosis, diverticulitis and peridiverticulitis.

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PLICATION OF THE HERNIAL SAC
IN OPERATING FOR FEMORAL HERNIA

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THE views of surgeons as well as those of internists are constantly changing, often undergoing a complete reversal, but on one surgical subject at least there has been no change of opinion since La Quin observed nearly two and a half centuries ago that the successful treatment of femoral hernia was much more difficult than that of inguinal hernia.

This question of dealing with femoral hernia has been of special interest to surgeons because of the fact that mechanical treatment by means of a truss is never satisfactory and is always more or less dangerous. The fitting of a truss for femoral hernia is difficult and when what seems a perfect fit has been made, the truss is certain to be displaced by movements of the muscles of the upper part of the thigh causing risk of strangulation and is a source of constant inconvenience and annoyance to the wearer.

Still another weighty objection to the mechanical method is that it never effects a cure. The surgical method being thus the only feasible plan for dealing with this defect, many efforts have been made to solve the various problems which the operation presents and numerous methods have been suggested. Interest has especially focussed on two steps, the treatment of the sac and the closure of the femoral ring. This paper relates wholly to the question of disposal of the sac.

The methods of dealing with the hernial sac proposed by various distinguished operators have been about as diverse as possible. The famous Billroth of Vienna, whose work the writer watched during the winter of 1883–4, opened the sac by a simple incision but did not remove it.

Lawson Tait, with whom the writer worked in 1889, operated through an abdominal incision and incised the sac only when adhesions were present, closing the ring with horsehair sutures. Socin excised the sac. Macewen twisted it and pushed it up into the abdominal cavity. Marcy excised the sac after carefully freeing it from adherent structures.

More than thirty years ago (1894) the writer, after trying various other methods, adopted a new plan of dealing with the sac which he described in a paper read before the Michigan State Medical Society at its annual meeting for 1896 and which was printed in the proceedings of the society for that year. From this paper[1] the following paragraphs are quoted:

Two years ago when operating on a case it occurred to me that an improvement might be made by turning the neck of the sac upward. I accordingly adopted the following procedure.

After transfixing and ligating the sac, instead of cutting all the ligature ends short, I left two of them hanging, then passed an aneurism needle from below upward along the canal and just outside of the hernial sac (hence extraperitoneal). I caused the blunt end of the needle to press outward at a point about $1\frac{1}{2}$ in. above the border of the femoral ring. Carefully cutting down upon the end of the needle, I slipped a loop of silkworm gut through the loop of silk with which the needle was threaded and then I pulled the aneurism needle back, dragging the loop of silkworm gut back with it, and the long ends of the ligature employed in tying the sac were slipped through the loop and thus pulled upward through the opening above the ring by making traction upon the ligature ends. I was thus able to drag the stump of the sac upward to a point above the internal opening of the femoral canal and at the same time to fold the sac upon itself, thus obliterating the passage at

[1] Kellogg, J. H. A new method for the radical treatment of femoral hernia. *Tr. Michigan State Med. Soc.,* 1896, xx.

the internal ring instead of simply closing it at the external ring. In dragging the mouth of the sac upward I also took pains to pucker and tie the surrounding faciae and other tissues which were drawn upward with the sac along the femoral canal by the successive application of three or four ligatures. In this manner I was able to fill the canal with consolidated tissue; the stump of the sac was fixed in its upturned position by threading each ligature end upon a needle and passing them through the tissue in such a way that by tying
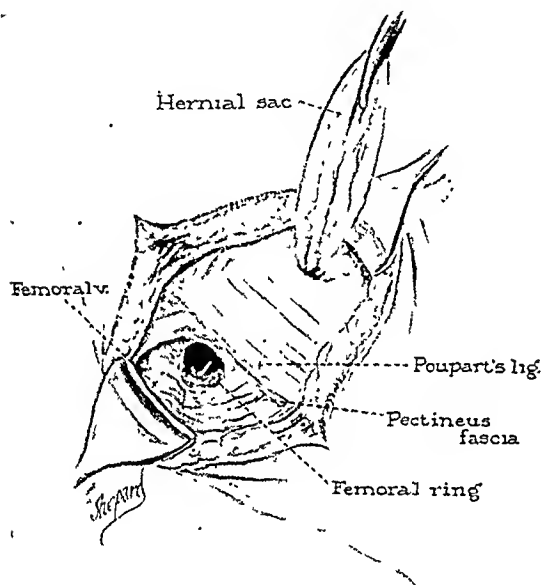
FIG. 1.

them the small opening through which they were first drawn was firmly closed. Sutures were then introduced and the wound was closed and treated in the usual way.

This plan succeeded so well that I have since adopted it in all cases of femoral hernia upon which I have operated. In one of these cases I was performing a laparotomy at the same time, and so took the opportunity to notice the effect upon the internal opening of the femoral canal produced by dragging the stump upward. The opening in this case was large enough easily to introduce the tip of my little finger from the peritoneal side. After the neck of the sac had been drawn upward and secured in place, the peritoneal end of the canal was found completely obliterated and it was scarcely possible to locate it. It was represented simply by the presence of a fold in the peritoneum. There seemed to be no

possibility of a return of the hernia and the subsequent history of the case has shown the patient to be radically cured. I was glad to have this opportunity of verifying the effect of turning the mouth of the sac upward in the manner described. .

In the several cases in which I have since employed this operation the results have been most satisfactory. In none has the rupture returned, although more than three years have elapsed since I first adopted the method.

A few years after the above paper was read, the writer was pleased to find in a then new edition of Kocher's Text-Book of Operative Surgery[1] a description of a very similar method of dealing with a femoral hernial sac in operating femoral hernia in which the sac is invaginated as well as turned upward. The following is quoted from the 1911 edition of the English translation of Kocher's work.[2]

The contents having been reduced, the apex of the sac is seized with curved "trans-position-forceps" and invaginated, the point of the forceps being passed upwards immediately behind Poupart's ligament on to the anterior abdominal wall, and made to project through an incision (4 mm. long) in the outer pillar of the external abdominal ring. The sac is then forcibly pulled out with artery-forceps, transfixed at its base, ligatured, and removed in the same manner as was described in inguinal hernia. The stump is buried and the small opening in the aponeurosis closed with a suture.

Kocher later adopted the plan of twisting the sac, ligating and folding it upward, while Ferguson, Macewen and Bishop simply twisted the sac and folded it upward.

This plan of using the sac to reinforce the weak area in the abdominal wall seems rational and it is gratifying to note its adoption by various able surgeons with each of whom, so far as the writer knows, it may have been as wholly original as with himself.

Figure 1 so well illustrates the essential features of the method that no detailed explanation is required.

[1] Kocher, T. Chirurgische Operationslehre. Jena, G. Fischer, 1897, pp. 199–203.
[2] Kocher, T. Textbook of Operative Surgery. N. Y., Macmillan, 1911, pp. 199.

NEUROLOGICAL COMPLICATIONS IN SURGERY

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THE neurologist frequently is in the fortunate position of consultant on problem cases. As patients are often referred by him to the surgeon, and to him by the surgeon, he is enabled to gather cases which in themselves are rare but collectively may be instructive in showing lurking dangers.

surgery, nerve palsies from setting of dislocated limbs, aphonia after thyroidectomies, radial nerve injuries in extended arms following Trendelenburg posture, and Erb-Duchenne's paralyses from podalic extractions.
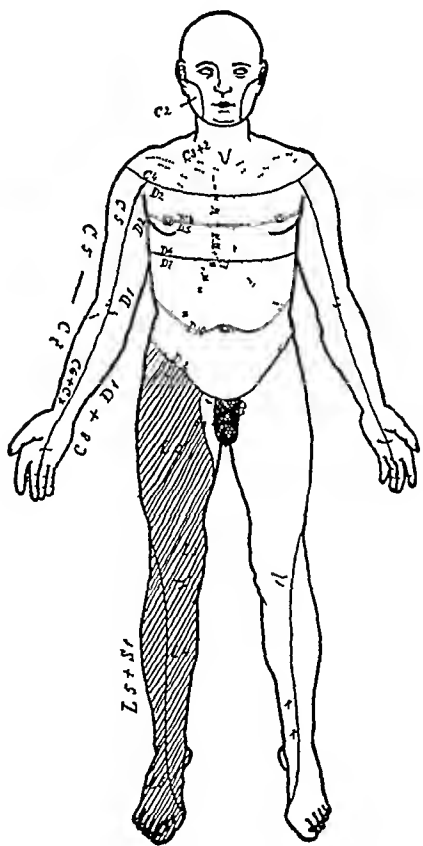
Fig. 1A.
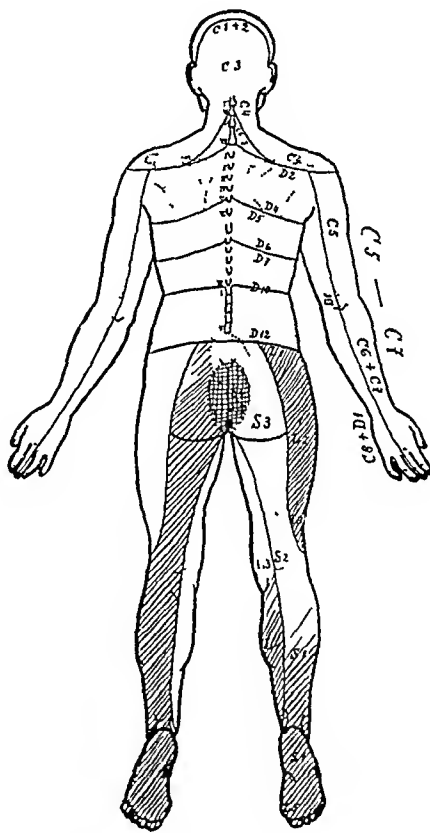
Fig. 1B.

Figs. 1A and b Case ii. Dark shading represents total anesthesia, light shading hypesthesia at time of first examination.

Among complications which are well-known and hence only to be mentioned in passing are the introspection and somatic fixation seen in psychoneurotics following

It is not my purpose to present here common complications but rather the unusual and little-discussed cases. Those presented have not been gathered from this clinic alone but are the most instructive and uncommon which have come to our attention.

CASE REPORTS

CASE I. Miss L. B., nurse, aged thirty-five, of a neurotic temperament but otherwise complaining only of rectal discomfort, was operated upon under gas anesthesia. Four large internal hemorrhoids were removed by the ligation method.

During the operation the lower limbs were suspended in stirrups. An inexperienced assistant, unnoticed, leaned against the right limb somewhat during the fifteen or twenty minutes of the operation.

When the patient recovered consciousness
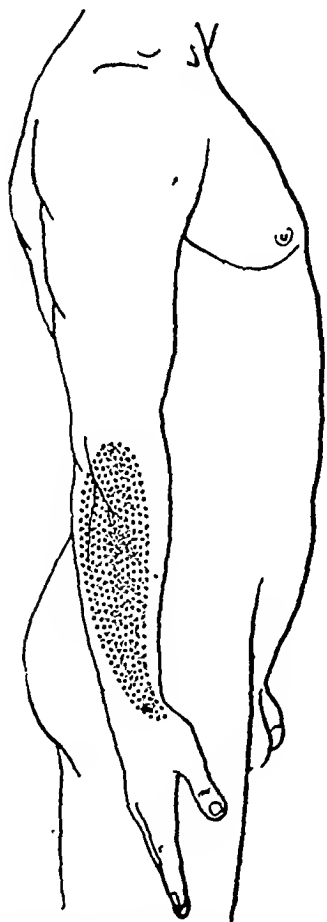
FIG. 2. Cutaneous anesthesia in complete section of the musculocutaneous nerve. (From JELLIFFE and WHITE, Diseases of the Nervous System. Phila., 1919.)

she could not raise the right foot above a right angle with the leg. On the sixth day when she attempted to walk she had poor control of the right foot and a foot drop. Examination disclosed tenderness along the peroneal trunk and the peroneal group of muscles. There was no anesthesia but considerable pain, which was not relieved by any of the usual mechano-therapeutic means. Massage and electrical stimulation were given and the function slowly returned, but even after eleven months the tendency to foot drop persisted.

CASE II. Mrs. I. T., aged thirty-six, was referred to a surgeon for perineoplasty, which was done under lumbar anesthesia. When this began to wear off the patient complained of severe pain in the tip of the coccyx and in the sacral region. This continued unabated for two weeks and was relieved temporarily by heat but not in any other way except by opiates. With the pain came a saddle-shaped area of total anesthesia in the perineum and buttocks, (see Fig. 1, A and B) rectal and vesical insensibility, and the patient became involuntary to urine and feces.

When she was seen two weeks after operation the foregoing was confirmed but there was in addition hypesthesia in the first and second sacral areas on the left and all lumbar segments on the right. The lumbar segments had escaped on the left, while the first and second sacral segments had escaped on the right. The pain was greatly increased by raising the trunk, straining, coughing or sneezing. A diagnosis of a cauda equina lesion was made, probably hemorrhagic. Improvement has been steady but slow. Five weeks from the onset, there was marked sensitiveness in the area formerly totally anesthetic. The other segments had returned to function but the patient walked clumsily. In six months there were still a few remnants in the form of hypesthesia.

CASE III. Mr. A. H. S., aged seventy-one, suffering from cardio-vascular-renal disease and maxillary sinusitis, was operated upon for drainage of the sinus. After local anesthesia the trocar was inserted in the usual way and air was gently forced into the sinus. Abundant discharge of pus through the natural sinus opening occurred. When this had drained, a little more air was injected but the patient immediately complained of "feeling funny." His head was lowered, all apparatus was removed and he was asked whether he wished to be carried to a chair or preferred to walk. He chose to walk but found himself unable to move his lower extremities. The arms were weak. The man had a thick, bulbar speech and some dysphagia. Examination revealed a diplegia with a bilateral Babinski reflex, which disappeared in four days. A vascular spasm in

the medulla was diagnosed. In two weeks the patient was as well as before.

CASE IV.   R. A., a boy aged fourteen, was taken with attacks of pain in the region supplied by the fourth to the seventh dorsal segments on the left side. The pain completely incapacitated him for a day at a time. There was constant exquisite hyperesthesia to light touch, even clothing causing severe pain. Bouts of pain with continuous hyperesthesia continued for four years, when the sensory roots in the segments named were cut by a neurologic surgeon. The pain in the original four segments was replaced by total anesthesia but it soon recurred in the segments above and below. Bleeding occurred into the spinal canal and gave rise in twelve hours to a total paralysis below that point. A second operation to relieve this condition showed that there was a general oozing; the patient was a hemophiliac. He was still paralyzed one year later.

CASES V, VI, VII and VIII.   These were all women operated upon by four different surgeons, but one description will apply to the four cases.

Following the operation it was found that the patient had one weak arm. She was entirely powerless to flex the elbow unless the forearm were first pronated and then flexion was still weak. In addition to the weakness there was an area of numbness and anesthesia as shown in Figure 2. The diagnosis was simple —musculocutaneous nerve paralysis. But the explanation of the mechanism by which the lesion was produced was not so simple.

Radial nerve lesions are well known in cases where the arm is inadvertently allowed to dangle during a pelvic operation in the Trendelenburg posture. But this had not occurred as the arm in question had been strapped to a board to obtain blood pressure readings. An analysis was much facilitated by having the neurologist placed in a similar but exaggerated posture for a few moments. It was found that an arm abducted to a right angle with the body and then pressed backward would give the precise conditions to cause stretching of the musculocutaneous nerve. Therefore, if the board supporting the arm were stuck under the table pad and a similar pad were not placed on the board, a musculocutaneous nerve paralysis resulted. All patients recovered and no similar cases have resulted since the technique was changed.

Hardly any comment is necessary. I have nothing new to offer in preventing such complications as resulted from the sinus drainage or from the lumbar puncture. The other types of complications may obviously be prevented.

SOME UNPREDICTED FEATURES IN
EXTIRPATION OF THE TEAR SAC

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BY necessity a textbook on surgery must describe a typical surgical procedure for each pathological entity. The variations, complications and less frequent findings are usually mentioned as well. When one essays a given operation, however, he must always be on the alert for the unexpected and for the rare. The following four cases belong to this group, observed during the course of the extirpation of the lacrymal sac.

CASE REPORTS

CASE I. A blind fiddler was brought in by a philanthropic friend to learn whether or not vision could be restored in either eye. There were destructive lesions of the tissues of the anterior segment of the eyes resembling the sequelae of trachoma; pannus, double symblepharon posterius, trichiasis and corneal opacities. The pus in the right cul-de-sac seemed to be coming from an infected chalazion that bulged the outer lid surface and opened through the conjunctiva of the upper lid near its margin. On pressure over the canaliculi there was no discharge. After anesthetizing the skin and subcutaneous tissues, a horizontal incision was made over the apex of the swelling in the skin of the upper lid and the tumefaction in its envelope was dissected out. It was a surprise to find that the dissection led under the skin but above, rather than under, the internal canthal ligament and down through the lacrimal fossa into the nasal duct. The duct was curetted. The content of the lacrymal sac was mucopus. Stitches were placed in the skin incision and a pressure pad was applied over the lacrimal groove. Healing by first intention ensued.

CASE II. Mrs. J. A., aged seventy, was referred for attention to an acute left dacryocystitis. The lower punctum was closed. The upper was partially closed. With a cambric needle the lower punctum was pierced and a No. 1 Bowman probe was easily placed up to the entrance into the sac. A No. 2 probe

entered the sac, and the sac was irrigated with warm boric acid solution. In a few days a No. 3 probe was passed into the lower canaliculus and a No. 1 probe through the upper one. Daily irrigations were made. Two per cent mercurochrome was left in overnight. Hot and cold compresses were applied at home. There was relief from pain, and the redness and swelling receded. However, after an absence of a few days, the patient returned with such an intense exacerbation that it seemed best to incise the sac. A small incision was made in the pointing area. With a lacrymal syringe the sac and nasal duct were irrigated. A wick was left in the wound and daily treatments were given until the inflammation in the surrounding tissue had subsided. But a few days after the wick was removed there was an ominous flare-up of the inflammation. Since the patient had pernicious anemia with cord involvement, the hemoglobin remaining below 40, it was with reluctance that we made our final decision to extirpate the sac.

Novocain and adrenalin were injected intradermally and subcutaneously in line with the former incision, into the deep tissues along the periosteum and about the base and dome of the sac. The skin was very friable. It was difficult to hold with forceps or speculum. The sac was large and tough and easily held. It was dissected out and the cavity swabbed with 2 per cent mercurochrome. On the floor of the cavity near the end of the fistulous opening there remained a small tag which looked like a piece of adherent sac. This was picked up with forceps and gently pulled off. At once the orbital fat began to ooze into the cavity. The removal of the tag had made a tiny opening in the septum orbitale. The fat was pushed back and held with cotton applicator while the lacrymo-nasal duct was curetted and swabbed with mercurochrome. Skin sutures were placed and a gauze pad was laid over the wound and held in position by a pressure bandage. The incision healed quickly. Redness of the skin of the lid, nose and cheek persisted for some time. The patient was seen every few days for two

months afterward. She had a crop of internal styes and a small infected retention cyst in the skin of the upper lid.

This case was of interest because we were forced to operate, although it was against our usual custom of not operating in advanced cases of pernicious anemia. The skin and septum orbitale were friable. There were no untoward results from replacing the hernia of orbital fat.

CASE III. Baby H., aged one and one-half years, with left dacryocystitis which developed

FIG. 1.

two weeks after birth and later opened spontaneously, leaving a fistula (Fig. 1).

Under gas and ether anesthesia, to control the bleeding, 1 per cent novocain and adrenalin were injected intradermally and subcutaneously about the scar tissue and the lacrymal fistula which had opened just below the lower canaliculus. To act as a director, a No. 4 Bowman probe was passed through the upper canaliculus and through the sac into the lacrymo-nasal duct. The probe was left in this position during the dissection of the epithelium that had grown into the fistula.

An elliptical incision was made including the fistula. The skin of the fistula was held with toothed forceps while the epithelium was removed with the curved scissors from the sides of the groove into which it had grown. Any remaining epithelial cells were cauterized with a small pointed electrode. The probe-director prevented the scissors and electrode from coming in contact with the sac except at the fistulous opening. Two stitches were placed in the skin incision, the needle and sutures having been run through sterile paraffin

oil. The lower canaliculus being patent only in the outer portion, the entrance through it to the sac was pierced with the small end of the Ziegler dilator. The probe-director was then removed from the upper canaliculus and the channel was irrigated with normal saline solution. Only a small portion of the solution passed into the nose; most of it found its way under the skin of the lower lid through the opening just made at the proximal end of the lower canaliculus. This was absorbed in a

FIG. 2.

few hours. This irrigation was repeated a few days later by way of the upper canaliculus. Silk isinglass plaster was placed over the skin sutures and a small pad and bandage were applied. Splints made of wooden tongue depressors fastened together with adhesive tape were placed on the flexor surface of each elbow to prevent the patient from pulling at the dressings. The stitches were removed on the fourth day. The wound had closed and the lacrymal passages were open. Now irrigation can be performed through either canal.

CASE IV. Miss M. C. M., student, aged nineteen, entered the clinic for treatment for poor vision, epiphora, photophobia and the removal of a tumor of the right lower lid.

She stated that when about ten years old she had a severe inflammation of her eyes that

persisted for nine months and left her with poor vision and epiphora on the right. Gradually a swelling developed about the internal angle of the right eyelids. On examination of the eyes the picture of hereditary syphilis was seen in all the tissues; there was a diffuse cloudiness of the interstitial cornea with minute blood vessels visible with the loupe, iris pigment on the anterior capsule, a yellowish papilla with hazy borders, and in each retinal periphery a characteristic chorioretinitis. On the right

FIG. 3.

there was a congenital conus beneath the disc and situs inversus of vessels, so that the poorer vision of this eye could be due in part to these anomalies. The right lower orbital border was rounded and smooth; the left was thin and sharp and notched. Her face was rather flat but the nose was not the typical saddle nose. There was a non-inflammatory fluctuating mass (Fig. 2) on the right lower lid extending from the nasal wall to the mid-line of the lower lid, well past the maxillary malar suture. The puncta were clean; there was no discharge from them and none on pressure over them. The irrigating needle could be entered at either canaliculus but the fluid returned clear through the same canaliculus. There was an obstruction by pressure or otherwise, distal to the union of the canaliculi.

On transillumination through the mouth a brilliant glow was transmitted through the whole of this tumor-like mass (Fig. 3). It was suggested by a noted visiting ophthalmologist that the lesion might be a productive cyst from a gumma of the bone and that the luetin test would help to solve the problem. Both Wassermann and luetin reactions were positive.

The roentgenogram revealed no disease of the bones of the orbit or face.

For cosmetic reasons the patient wanted the tumor-like mass removed.

The skin of the right lower lid was cleansed

with iodine and alcohol. Novocain and epinephrin were injected intradermally and subcutaneously along the upper border of the tumor, and a curved incision about one inch long was made through the skin and subcutaneous tissue, parallel to the orbital crest, from a point 4 mm. lateral from the internal angle of the eye. The thick capsule of the tumor presented at once. The skin margins of the wound were dissected from this mass and held with small toothed forceps. Novocain
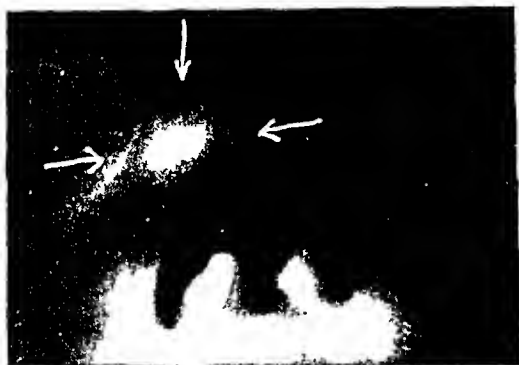
FIG. 4.

was then injected beneath the subcutaneous tissue. The mass was removed with curved blunt scissors and spatula dissection with snipping of many tough connective tissue bands between the sac and the periosteum of the malar and superior maxillary bones. The pedicle of the mass led mesially and downward to the lacrymo-nasal duct and was excised after the dissection had been carried as far down as possible. The nasal duct was curetted of its mucous membrane well down to the floor of the nose. The cavity was swabbed with quarter strength tincture of iodine. Silk sutures and needles were run through sterile oil and five stitches placed. A rather long, round pad of tightly wound iodoform gauze was laid along the length of the wound and a pressure bandage was applied over all.

The mass proved to be a pure mucocele of the lacrymal sac. The wound healed by first intention. The transillumination after removal of the sac and its contents was very faint, almost nil (Fig. 4). The clear content of the colloid substance of the mucocele was evidently the source of the brightness seen on transillumination.

The case is reported because of the size and position of the cyst and the extent to which it had burrowed, and the rarity of a pure mucocele with brilliant transillumination, which transillumination faded with its removal.

FACTORS IN THE
ADMINISTRATION OF ETHYLENE

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DURING the past four years ethylene has been thoroughly tested and has proved to be one of the best of our general anesthetics. This is at once evident by its widespread use in practically all the large surgical clinics. Its numerous advantages over other general anesthetics, as stated by Chipman,[1] are:

1. Patients quickly anesthetized and rapid recovery.

2. Reduced postoperative nausea and vomiting.

3. Absence of cyanosis.

4. Relaxation.

5. Period of analgesia and anesthesia.

6. Absence of sweating.

7. Absence of headaches.

8. Absence of gas pains.

To these we wish to add and emphasize the lack of excitation or stimulation of the nervous system, as shown by normal respiration and circulation, lack of muscular movement and sweating, and in nearly all ways the simulation of natural sleep.

Among the few contraindications to the use of ethylene is its explosibility, and yet, as several writers have observed, it differs very little from ether in this respect. It is probable that if accurate figures were obtainable, the ratio of fires and explosions due to ether would be found to be as high as those due to ethylene.

The danger of explosion has been ignored or made light of by some. This is likely to result in trouble sooner or later. On the other hand, in considering the danger of explosion of ethylene, we should not become frightened as some have and refuse to use what is probably the best anesthetic we have at our command today.

Explosions that have occurred seem to be largely due to static charges on either (1) the apparatus, (2) the anesthetist, (3) the patient or (4) those standing near. We believe there is little evidence from the explosions that have occurred to indicate that they could have been caused by internal causes such as:

1. Spontaneous explosion.[2] There seems to be abundant evidence that there is no danger from the pure gas under high pressure in the tanks, as many thousands of cylinders have been filled and shipped to all parts of the country.

2. We know of no evidence that it forms explosive compounds with copper and other metals as does acetylene.

3. The gas is now made of such high purity (99.5 + per cent) that it is very improbable that it contains any impurity which on contact with oxygen would increase the fire or explosive hazard.

Preventive measures then should consist in thoroughly dissipating by adequate grounding any charges that originate at any one of the above four points.

A successful system of preventing the accumulation of a charge, which is available at little expense and trouble, is shown in the accompanying illustration (Fig. 1). From the reducing valves (1) connected to the tank, a small insulated copper wire (2) runs along the gas tubes to the metal head of the anesthetic machine (4). The ends of the wire are soldered in place. The outside of the rubber bags (3) is covered with a metallic paint which is a good conductor. This establishes contact with the metal parts in several places. Within each rubber bag is placed about one pint of water. By means of the water in the bags and the film of moisture all over the inside of the bags, connecting with the metal tube to which the bags are attached, and by means of the moist cloth (12A)

connected to the metal frame at the back of the apparatus, any potential set up by the gas escaping under high tension through the reducing valves or by friction in the rubber tubes is at once grounded before the mixing of the ethylene and oxygen. The outside of the rubber tube (5) is coated with the metallic paint, thus dissipating any charge due to friction on this tube. Within the tube is a bare spiral copper wire soldered to metal at each end.

thicknesses of moist gauze, which is much more pliable and easily adjusted. The anesthetist (9) is connected in the circuit by his hand on the mask (6). He is grounded and thus again grounds the circuit through the moist cloth (12B) upon which his feet rest or (12C) a moist cloth attached to his metal stool. The table (10) is connected into the circuit by the insulated wire (11) which is soldered to the metal head (4) and by means of a
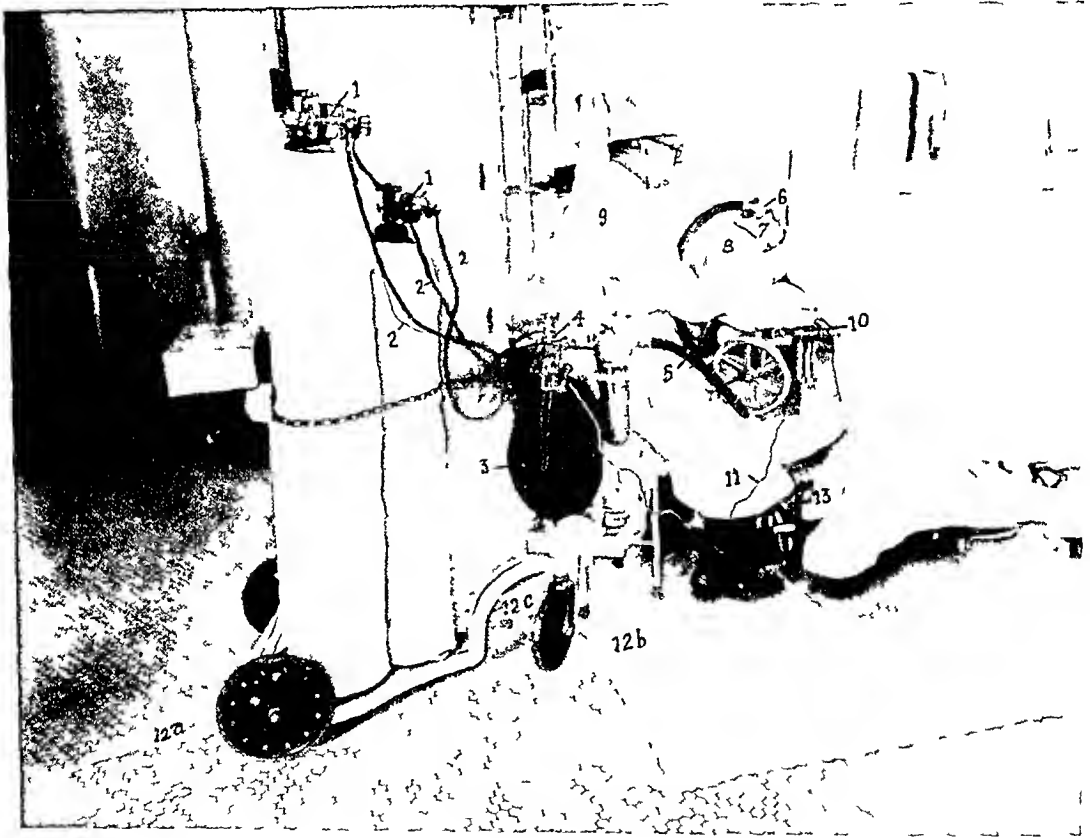
FIG. 1.

It has also seemed advisable to solder a connection to the metallic spiral in the wall of the rubber tube which prevents the tube from kinking. After the tube has been used some time this metal occasionally becomes exposed to the flow of gases within the tube. Before each operation, water is run through the tube and mask, leaving them wet. The metal of the mask (6) is thoroughly connected to the patient (8) by means of a wet towel (7) or several

convenient battery clip is easily attached to the table. The table is also grounded through the adjustable metal leg (13).

The above description assumes the floor to be a good ground. This and the efficiency of all parts of the circuit are easily and thoroughly tested by means of a small static machine and electroscope.[3] In this way a charge can be placed at any point and its presence or absence shown by the electroscope. Cement and tile are

usually good conductors, especially if kept moist, but wood, linoleum and rubber-covered floors are poor conductors. Under such conditions a special system of grounding must be worked out. This is important for everyone knows how easy it is to produce a static spark on an insulated floor. This was strikingly brought to our attention recently. In an obstetrical department with linoleum floor, one of us just lightly brushed a rubber pillow with a sleeve and the next instant a spark about half an inch long jumped to the table.

Especial care must be taken to obtain thorough grounding in obstetrical departments as much movement by the patient, exposure of the rubber surface of pillows, pads, etc., and the frequent removal of the mask from the patient's face, result in considerable friction. We, therefore, coat the pillows and pads with a metallic paint and take care that they maintain contact with the table. With a little attention to proper grounding, we feel that ethylene is entirely safe and is the anesthetic of choice for obstetrical work, especially from the standpoint of the mother and child.

It is probably due to the humidity that some have been able to escape accident when using ethylene extensively without grounding precautions. But natural humidity is very changeable and cannot be depended upon in such an important matter. In many of the larger hospitals a forced system of ventilation is now used in the operating room. Two important results have been secured by this means. The air entering the room is passed through a water spray, the temperature of which can be controlled. Thus a high humidity is produced in which it is practically impossible to develop static and the temperature is kept constant even on the hottest summer days, making the working conditions very satisfactory.

In the system described above we believe the presence of moisture at several points is the most important single factor. In fact this alone would insure a large degree of safety.

It seems to us that the above precautions are not burdensome or so elaborate as to defeat their purpose. If they are taken, we believe they will eliminate such accidents as reported by Allen and Murray,[4] due to failure to completely turn off the gas or to a very rich oxygen mixture. With us it has become a simple routine, easily carried out and has proved entirely effective.

SUMMARY

1. Ethylene has proved to be one of our best general anesthetics.
2. Danger of explosion cannot be ignored. On the other hand we should not become frightened into refusing to use it.
3. A successful system for preventing explosions is described.
4. Emphasis is placed on the importance of moisture at several points in the use of the system.

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ACQUIRED
ELEPHANTIASIC SCROTUM
WITH CASE REPORT OF NEW PLASTIC METHOD

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UNDER the term acquired elephantiasic scrotum may be grouped the endemic cases in the tropics, elephantiasis tropicum, and the sporadic cases of temperate climates, elephantiasis nostras. The sequence of pathologic events producing tropical elephantiasic scrotum may be summarized as follows (Manson):

(1) Parent female filariae in the lymphatic system draining the scrotum.

(2) Obstructive fibrotic changes in the inguinal lymph glands and lymphatic trunks.

(3) Stasis of lymph in the scrotum ("lymph scrotum").

(4) Lymphangitis due to bacterial invasion through skin wounds, to toxins from the worm itself, or to products of the disintegration of microfilariae in the congested area.

(5) Imperfect absorption of the products of inflammation.

(6) Recurring attacks of inflammation from similar causes leading to gradual, progressive hypertrophy of the part.

The mechanism for the production of elephantiasis nostras is probably much the same, i.e., lymph stasis which may be due to bilateral inguinal adenitis, etc., chronic recurring inflammation, imperfect absorption of inflammatory products, and the final slowly progressing hypertrophy.

Tropical cases often attain enormous proportions. The largest reported by Manson[1] weighed 224 pounds. As ordinarily seen they range from about 10 to 20 pounds, although cases are commonly reported of 35,[2] 36,[3] 50[4] and 86[5] pounds respectively. Elephantiasis nostras as usually seen in the clinics of this country would not average much above 10 pounds,

although occasionally one reads reports of enormous cases. Thus Windell[6] quotes a case of Campbell's, weighing 226 pounds! The interesting feature of this unusual case is that the patient wore an inguinal truss for twenty-five years. So it is probable that elephantiasis nostras has the same potential elements for enormous enlargement as the filarial elephantiasis. In fact these two types of the disease exist side by side in the tropics and resemble each other very closely. Even in their microscopic structure they are similar. As morbid processes they are histologically alike and differ only in the primary cause of the lymphatic and venous obstruction which initiates the process (Matas[7]).

Clinically, it appears that in the majority of cases of elephantiasis nostras the penis and scrotum are both separately and enormously enlarged. On the other hand in elephantiasis tropicum the penis is usually buried under the skin and subcutaneous tissue of the upper and anterior surface of the large scrotal tumor. This difference, then, although not constant, is seen often enough to warrant mention.

ETIOLOGY

Climate. It is well known that elephantiasis is common and endemic in the tropics, and that one of the most commonly seen forms is the elephantiasic scrotum. Matas[7] would have us believe that

The reason why elephantiasis as a clinical entity is so much more frequent in the tropics is because the conditions which favor cutaneous infection as well as lymphatic obstruction are so much greater than in colder climates; greater exposure of skin areas, especially lower extremities, to traumatism of all sorts; greater

activity and consequent greater irritability of skin; universal presence of suctorial insects and parasites; greater frequency of eruptive diseases, etc.

Race. It is also significant that the majority of cases of elephantiasic scrotum occur in colored races. Anyone having practiced medicine and surgery among the dusky races of the tropics must have been impressed by the frequency of cases of fibrosis, fibromata and fibromyomata. Among these people the most carefully approximated surgical incisions become keloids sooner or later. So undoubtedly this racial characteristic of reaction to injury by fibrosis is of considerable etiological importance.

Filaria in Endemic Cases. Filaria Bancrofti with its resultant lymph stasis is certainly the initiator of many cases of scrotal elephantiasis tropicum. However, a large percentage of cases of "lymph scrotum" never develop elephantiasis. Manson[1] himself states that lymph stasis alone does not cause the disease and further that erysipelatoid inflammation, frequently recurring, is a well-recognized feature of almost every case. Some authors attribute more importance to filariae. Thus, Low (quoted from Matas[7]) asserts that if a lymphatic obstruction caused by adult filariae is followed by an attack of erysipelas, the filarial embryos are killed and their disorganization is a cause of the lymphangitis which culminates in elephantiasis.

Bacteriological Causes. In contrast to this view, Dubruel (quoted by Shattuck[8]), in observations extending over three years in Tahiti, found that while elephantiasis was common among the natives (one-twelfth of the population), filariasis was practically absent. He examined the evening blood in over two hundred cases with negative results and did not see a single case of chyluria. Cultures from his cases yielded staphlococci, streptococci and diplococci. He therefore concluded that recurring attacks of inflammation due to these organisms is the principal

etiologic factor. Manson[1] recognized the difficulty of demonstrating the microfilariae in the night blood, as he was able to demonstrate them in only one out of fourteen cases of elephantiasis scrotum.

In regard to the sporadic cases encountered in temperate climates, most authorities are agreed that the exciting cause is recurring inflammation by pathogenic microorganisms of the streptococcal group. Unna[9] taught that the exciting bacteria remain latent in the tissues between attacks of active inflammation. If we accept the views of Le Dantic, Sabourand and Unna, and many others, the progressive fibromatosis which we recognize as elephantiasis nostras may occur independently of any stagnant state of the lymphatic or venous circulation and solely as a resut of repeated attacks of a streptococcal infection. (Matas[7]).

Syphilis and Tuberculosis. Syphilis is a rare cause for scrotal elephantiasis. Marshall[10] reported a proven case in a colored man in Tennessee. He mentions the rarity of the condition in America. In his article he has collected six other cases of proven syphilitic elephantiasis; most of these had positive Wassermanns and were cured by antiluetic treatment. Another more rare cause is tuberculosis (Gougerot[11]).

Miscellaneous Causes. Windell[6] wrote on genital elephantiasis following extirpation of inguinal glands, detailing two cases of his own and mentioning nine others which he collected from the literature. So we are again well warned that every skin incision should be carefully planned to avoid disagreeable results from scar, loss of skin sensation, lymphatic blocking, or severance of nerves or blood vessels (Speed[12]). Orr[13] reports a case following gonorrhea and bilateral inguinal lymphadenitis and Speed[12] reports one following drainage of suppurating inguinal adenitis.

PATHOLOGY

In acquired elephantiasic scrotum the skin is usually greatly thickened in the

most dependent portions of the tumor. It may be smooth and shiny with prominent pores or it may be coarse, thrown into folds, with a wart-like surface. There is usually a zone of rather solid subcutaneous edema between the diseased and the healthy skin. The whole mass is firm and brawny in consistency and on section has a blubbery appearance, which gives off a copious flow of lymph. The testicles and cords are found located at the upper and posterior part of the mass. In the majority of cases they are found to be in a healthy state. There may or may not be an associated hydrocele of the tunica vaginalis.

The histopathology of the skin is as follows (Matas[7]):

1. Mechanical blocking of veins and lymphatics.

2. Hyperplasia of collagenous connective tissue of the hypoderm.

3. Disappearance of elastic fibers of the skin.

4. Existence of hard lymphedema ("coagulable dropsy").

5. Chronic reticular lymphangitis caused by secondary and repeated invasion with bacteria of the streptococcal group.

The most striking pathologic change is hyperplasia of connective tissue. This is first apparent in the deeper layers of the skin. Then, penetrating to the subcutaneous tissue along nerves and vessels, the fibrous hyperplasia leads to atrophy of fat and muscle, finally replacing them entirely (Shattuck[8]).

CLINICAL CONSIDERATIONS

The onset of the disease is marked by fever; the skin of the affected part, the scrotum, becomes red and inflamed with small vesicles on the surface. These attacks of cutaneous infection frequently recur and each one leaves in its train a permanent distention of some of the lymphatics. The subcutaneous tissue is at first soft and edematous and pits on pressure; after a time it becomes hard and brawny, and the skin is either covered with vesicles and

dilated lymphatics or in the later stages is eczematous, roughened, tubercular and horny (Bowlby and Andrews[14]).

This disease in the tropics is characterized by a large scrotal tumor suspended from the puboperineal region and having the penis buried within the mass. Over halfway down on the anterior surface is a small slit which represents the termination of the stretched out prepuce. The coarse thickened skin of the most dependent portions of the tumor fades gradually into healthier skin around the sides of the growth toward what might be termed the pedicle. Frequently groin glands are present and there may be an associated elephantiasis of one or both legs. It is often remarkable that so few symptoms are complained of by patients having huge elephantiasic growths.

The majority of cases of elephantiasis nostras exhibit enlargements of varying sizes of both penis and scrotum. In a case reported by Orr[13] the greatest circumference of the scrotum was twenty-eight inches and the penis seven inches. Such cases commonly followed bilateral inguinal adenitis of venereal origin. This was true of Orr's case mentioned above and also in one of Speed's.[12] In fact both of these patients had urethral strictures as well as bilateral inguinal adenitis.

TREATMENT

With the exception of the rare cases of luetic elephantiasis, the treatment of this malady is always surgical. Castellani and Chalmers describe a case greatly improved by compression bandages and injection of fibrolysin. But this method is not used today since it has failed to yield constant results.

There is no accepted technique in operating upon elephantiasis nostras. Lymphangioplasty as advocated by Handley is used alone or combined with other methods. Speed,[12] in operating upon a case of elephantiasis nostras through a central incision in the scrotum, removed several pounds of elephantiasic tissue from each

half of the scrotal tumor. He then tunneled from the scrotum subcutaneously to the suprapubic region on both sides, made small incisions over the upper ends of the tunnels, probed a 12 in. forceps up from below and pulled down three strands of braided silk beneath the subcutaneous tissues of each side. Keysser[15] describes a case that had been treated by Handley's method with failure four months previously. He reoperated and removed a portion of the anterior rectus sheath and turned down a portion of fascia, also utilizing the channels produced by the silk in the previous operation.

The following technique was utilized by Orr[13] in operating upon his case: Bilateral herniotomy incisions were made, the aponeurosis of the external oblique was divided above the cord, the internal oblique sutured to Poupart's ligament, the testicle drawn up, the tunica vaginalis opened, turned inside out, sutured behind the cord and upper epididymus and replaced. The external oblique was sutured beneath the cord and the wound closed in the usual manner. The most of the scrotal mass was amputated, leaving the testicles and sufficient skin for a new scrotum. This ingenious method forms an anastomosis between the superficial and the deep lymphatic vessels.

While in elephantiasis nostras it takes some efficient method of lymphatic drainage as well as removal of diseased tissue to produce a cure, it would appear that this is not the case in elephantiasis tropicum. In the latter condition it is known that complete ablation of all pathologic tissue is sufficient. The technique described by Manson[1] is widely employed. A rubber tourniquet is used as a figure-of-eight with the large loop about the patient's body and the small loop about the neck of the tumor. Shallow transverse incisions are made across the perineum and the pubis, their extremities being connected by lateral semilunar incisions. The channel of the stretched prepuce is slit through, the penis dissected free and

the prepuce severed around the corona. A search is made for the testicle and cords, freeing them up to the external ring on each side. The neck of the tumor is severed close to the perineum and pubes, while the testicles and cord are retracted to one side. Flaps are closed over the testicles and the wounds are closed in the shape of the capital T. It is usually necessary to skin graft the penis later.

In studying over this technique it seemed feasible to work out a plan whereby primary flaps for the penis could be provided, together with ample skin for the formation of a scrotal sac. In doing this it is important that healthy skin always be used for the skin flaps. Since the postoperative fate of flaps is determined by an adequate blood supply, it is important that they be cut with a broad base, that subcutaneous tissues be preserved wherever possible, and that injury to the dorsal vessels of the penis be avoided. Furthermore the flap incisions should be located anatomically so that no twisting or stretching is necessary.

AUTHOR'S METHOD

Careful preliminary preparation is necessary. The patient is admitted to the hospital a week before operation. The tumor is kept slightly elevated during this time. He is given a daily bath, and the perineal region and the scrotal tumor are shaved. The day before operation he is given a sitz bath in a weak lysol solution, special attention being paid to the creases and the slit leading to the penis. The tumor is scrubbed with alcohol and half-strength tincture of iodine. A sterile towel is then tied about the enlargement. The morning of the operation he is given an enema and, as recommended by Bell, one hour previous to operation is placed upon the table with the scrotal mass elevated. No tourniquet is used as it is a hindrance in the formation of the flaps. The tumor and surrounding skin are thoroughly cleansed with alcohol and tincture of iodine. Beginning in the perineum (Fig. 1A) with the tumor

retracted onto the abdomen, a semicircular flap is marked out on each side of the tumor. These marks begin in the perineum about two inches in front of the anus and extend well up on each side of the growth, terminating about 1 in. below the external ring on each side. The incisions follow these marks and are made through the subcutaneous tissue, the flaps thus formed being dissected upwards to their bases (Fig. 1B). The large vessels met with are clamped and ligated and attention is then turned to the anterior aspect to the swelling. The slit which leads to the penis (the stretched-out prepuce) is taken as the guide to the lowest extent of the penile skin flaps in front. A transverse incision, starting 2 in. lateral to the slit and at a slightly lower level, is carried across to the same point on the opposite side (Fig. 1C). These incisions are then turned upward at right angles and terminate by joining the anterior extremities of the lateral scrotal flap incisions (Fig. 1C). The dissection of the anterior or penile flap starts below the
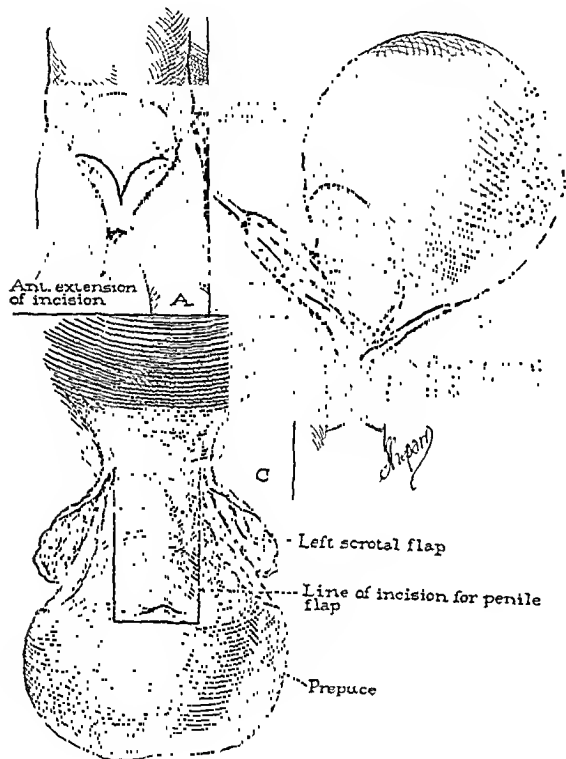
FIG. 1.

slit and consists at first of a median cutaneous tube (Fig. 2A), the stretched-out prepuce, together with a lateral flap on each side. This is dissected upward and leads to the buried penis, which is dissected free together with the lateral flaps which are left attached to its dorsum. This maneuver is an important one as it avoids injury to the dorsal vessels. The penis and flaps are protected in warm saline sponges and retracted to one side. On each side of the
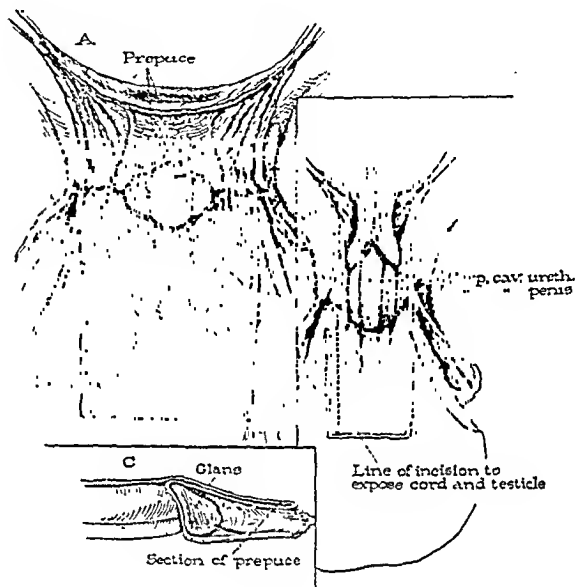
FIG. 2.

bed of the penis an incision 3 to 4 in. in length is made into the solid tissue of the growth to find the testicles (Fig. 2B). They are usually identified without much difficulty and are lifted upward, enabling one to dissect the corresponding cord up to the external ring (Fig. 3A).

If a hydrocele is present it is dealt with by excision of the most of the sac, followed by an eversion suture. The testicles and cords are placed at one side in warm saline packs. The remainder of the mass is now dissected rapidly from its attachment to the puboperineal region at what might be termed the pedicle. Many large vessels will be encountered on each side and are divided between double ligatures. The veins are left as long as possible before ligature, the arteries being dealt with first,

thus allowing as much blood as possible to return to the general circulation. The cord, which is usually considerably stretched, is partially shortened by a vertical gathering suture of catgut which is tied rather loosely. The cord may be further shortened by placing it around the testicle (Fig. 3B, C) and fastening it in place with at least two interrupted sutures of plain catgut. The preputial tube is inverted down over the penis (Fig. 3A, B). The penile and

skin and the skin over the penis and upper sides of the tumor must be in a sufficiently healthy state to be utilized as skin flaps. Edema of the skin is not a contraindication to the use of the method but one could not employ this operation where the skin is grossly diseased.

CASE REPORT

G., native male, aged forty-five, presented himself at the Kanye Dispensary, Bechuana-

Prepuce

A

B

Loosely tied 'hering' suture in cord

C

Edges of penile and scrotal flaps approximated with skin clips

Cord and testicle dissected from mass

Rubber dam drain
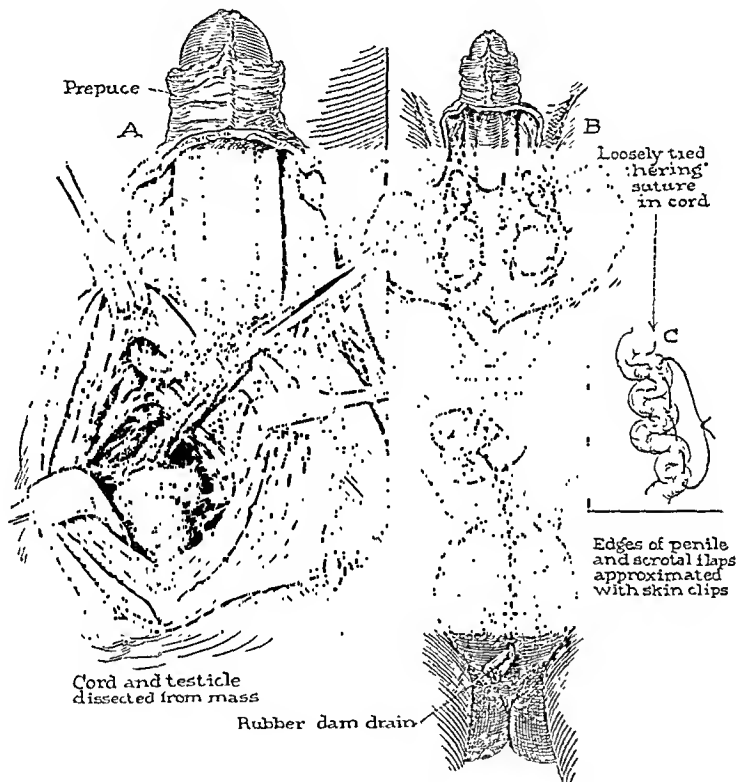
Fig. 3.

scrotal flaps are now brought together in the median line for the closure which is carried on from above downward (Fig. 3D), the subcutaneous tissues being united with interrupted catgut where possible and the skin with Michel's clips. A rubber tissue drain is inserted and carried out of the lower angle of the incision.

LIMITATIONS

It is recognized that this method is not applicable to every case but there is only one limitation to its use, viz., the preputial

land, South Africa, August 5, 1925. He had a large scrotal swelling (Fig. 4A). He stated that the trouble had started six years previously with swelling and pain in the left testicle, and further that the enlargement was rather rapid so that it soon involved the right side. He denied having a urethral discharge nor was a history of lues obtainable. He gave a history of pain and inflammation four or five times a year, and said that he had some difficulty in urination.

Examination (August 5, 1925) revealed a large scrotal swelling presenting a slit about midway down its anterior aspect. The swelling

was 14 in. in diameter. The glans penis was palpable a finger's length above the slit opening, on the anterior surface. The skin felt greatly thickened on the under surface, and toward the left side there were two small sinuses discharging pus. The right side of the mass felt firm and solid, while the left side was softer. No fluid thrill was obtainable and transillumination was negative. There were several enlarged groin glands on the right side but none on the left. The blood was negative for microfilariae on repeated examination. The

with hot normal saline and closed as previously described, using rubber tissue drainage. The mass weighed 13 lbs.

Postoperative Course. The temperature varied between 99° and 103.4°F. but returned to normal by the twelfth postoperative day. There was considerable oozing of blood during the first night. The clips were removed on the seventh day. There was a small skin slough at the junction of the penis and the new scrotum which healed by the nineteenth day. The rubber drain was removed on the ninth

FIG. 4A.

FIG. 4B.

urine was negative for sugar, albumin and pus.

Diagnosis: Elephantiasis scrotum.

Operation: August 23, 1925. Technique used as above described. The findings were interesting. A large hydrocele was found on the left side enclosed in a dense fibrous sac at least 3 in. thick. The testicle was found in the upper and posterior part of the sac. It was freed together with its cord, and the tunica was inverted and excised after the method of Winkelmann. On the right side at least 4 in. of fibrous tissue was incised and a cavity about 2 in. in diameter was opened into. This cavity contained foul pus which was evacuated. The testicle on this side was represented by a small knob of disintegrated tissues and was not dissected free. The mass was then excised and the wounds cleansed

day. There was considerable serous discharge up to the sixteenth day. It was necessary to incise twice for small localized collections of pus. The patient left the hospital on the twenty-second day in good condition (Fig. 4B).

The patient was last seen September 10, 1926. His genitals seemed perfectly normal and on casual inspection it would have been impossible to tell that he had ever had an operation.

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PAIN AND MUSCULAR ATROPHY

TRACED TO ABNORMALITIES OF THE SPINE

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THE frequency with which the neurologist is called upon to aid in diagnosing the cause of unusual and vague pain without localized tenderness has made it necessary for him to study the remote

FIG. 1. Distribution of pain (light shading) and of atrophy (heavy shading) in Case 1.

often has covered the site of pain only. For instance, a patient is frequently sent to the roentgenologist for examination of his shoulder because of pain or muscular atrophy in that region. The shoulder is
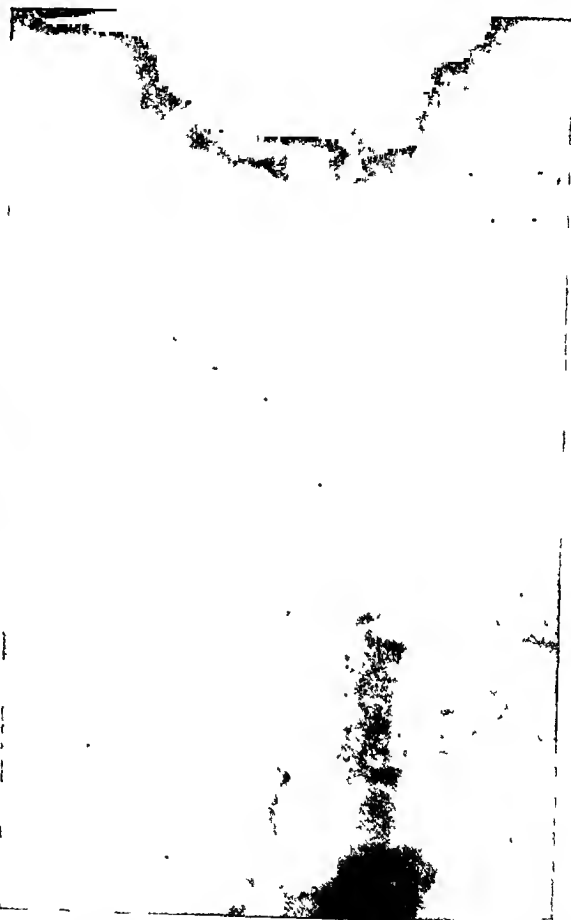
FIG. 2. Showing an old fracture of the fifth and sixth cervical vertebrae, with partial compression of the bodies on the left side in Case 1.

pathology of this annoying condition. This has led to a thorough investigation of the condition of the spine in these cases.

The roentgenologist has met with frequent failure in his efforts to assist his colleagues in the diagnosis of these cases for the reason that his examination very

found to be perfectly normal, but if the roentgenologic examination is more extensive, covering the cervical spine, the real cause of the pain in the arm and shoulder is demonstrated. Therefore, with proper cooperation between the neurologist and

roentgenologist, a better understanding of these cases can be obtained and the reason for the distress located.

To illustrate our point of view we wish to report a few cases.

REPORT OF CASES

Case i. J. A. M., white, aged forty-five, an executive, who twenty-five years before had sustained a comminuted fracture of the left elbow in a football game, complained of a severe scalding pain in the dorsum of the left arm and forearm for a period of seven years. Physicians consulted had invariably ascribed the pain to the fractured elbow. Questioning

the end of this time he strained at an obstinate garage door and immediately all his old symptoms returned, much aggravated. At night he would lie for hours on the floor crying with pain, unable to sleep.

Examination did not demonstrate any tenderness whatever in the arm, but showed almost complete atrophy of the biceps and triceps, with a little atrophy of the muscles of the forearm. There were fibrillary twitchings and marked weakness of the arm muscles as well as spasm of the muscles of the neck. Pressing the head to the right relieved the pain, to the left produced it, but this the patient had never discovered.
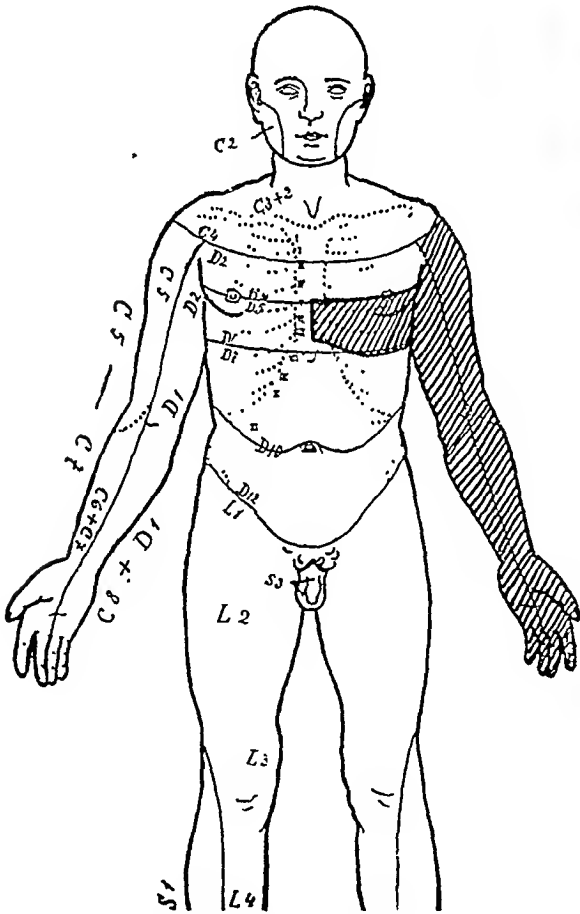
FIG. 3. Distribution of pain in Case II.

FIG. 4. Showing osteoarthritis involving the sixth and seventh cervical vertebrae in Case II.

revealed that he had taken some strenuous chiropractic treatment one year prior to the onset of symptoms.

Six weeks before his visit to the Battle Creek Sanitarium, the patient had received a severe jar to the left arm which gave him complete relief from his symptoms for five weeks. At

As the muscles involved are innervated not by a single peripheral nerve but by the fifth, sixth, and seventh cervical roots, a roentgenogram of this region was requested. This disclosed an old fracture of the fifth and sixth cervical vertebrae, with partial collapse of the bodies on the left side (Figs. 1, 2). The consequence was a marked scoliosis. There were

also considerable formation of exostosis in the affected area and a compensatory scoliosis in the dorsal region.

The patient was given massage, hot and cold percussion douches and corrective manipulations to overcome the scoliosis, and was then fitted with a collar flanged to shoulder pieces. A brachial plexus neuritis developed under treatment and this was treated in turn. After five weeks the pain disappeared entirely and had not returned one year later. He wore the collar twelve hours a day for three months.

CASE II. J. C. R., male, aged forty-six, who had been exposed much to weather and

some of the cervical vertebrae, particularly the sixth and seventh (Figs. 3, 4). There was also some lipping of the borders of the articular surfaces of the upper dorsal vertebrae, particularly the fifth, sixth, and seventh.

A tonsillectomy was done, after which the patient was treated for two months with heavy spinal massage and revulsive hydrotherapy to the cervicodorsal region. He was also given two courses of ten intravenous injections each of iodid, colchicum and salicylate. When the patient left he still had pain about the region of the heart, but was free from arm and shoulder pains. He stated he was 90 per cent relieved.
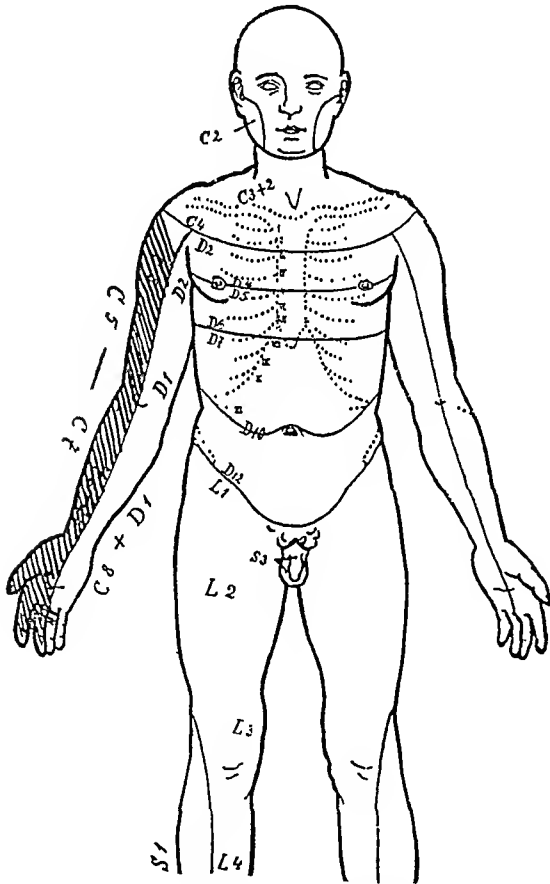
FIG. 5. Distribution of pain in Case III.

FIG. 6. Shows osteoarthritis involving the fourth and fifth cervical vertebrae in Case III.

hardships for years, complained of pains of a year's duration about the left chest and in the left shoulder and arm. There was no tenderness whatever in the painful area. Manual pressure on the neck to the right relieved the pain somewhat, pressure to the left aggravated it.

A roentgenogram showed considerable lipping of the borders of the articular surfaces of

CASE III. W. A. R., a physician, aged fifty-two, complained of pain in the right index finger which in the course of some days spread "along the course of the radial nerve until it reached the shoulder." The entire arm had been painful for four months. The patient also had an emotional depression and multiple arthritis.

Physical examination gave us no help except to rule out neuritis as there was no tenderness along the course of any nerve. A roentgenogram of the cervical spine showed considerable roughening of the articular surfaces of the fourth and fifth cervical vertebrae, and there was some lessening of the intra-articular space (Figs. 5, 6), characteristic of osteoarthritis. The bones of the right hand were normal.

The patient was given gentle stretching of the neck, massage and revulsive hydrotherapy to the affected area. He continued this for two weeks but in a fit of agitation with depression he boarded a train and went home. His case could not be followed.

consultation. A great deal of tenderness was found in the region of the distribution of the pain and after an examination in the home a diagnosis of neuritis was made. The patient was advised to come to the institution for a thorough search for a focus of infection. After a week of futile examination, another and more careful physical examination was made and it was then discovered that while the patient had tenderness in the right arm she also had pain in the left and in the trunk and lower extremities. In fact she tolerated pain so poorly that a universal tenderness was present. A radicular cause of her "neuritis" was then suspected and a roentgenogram of the neck
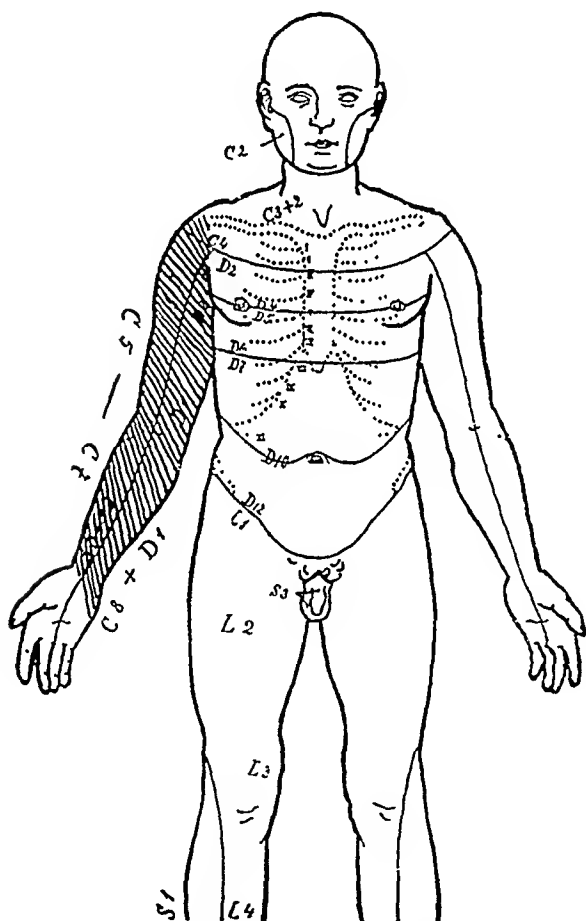
FIG. 7. Distribution of pain in Case IV.

FIG. 8. Showing osteoarthritis involving the sixth and seventh cervical vertebrae in Case IV.

CASE IV. Mrs. M. D., aged forty-four, had suffered from "neuritis" of the right arm for years, during which time she had been attended by an osteopath. When the pains became incapacitating and no relief was obtained either day or night, one of us (J. M. N.), was asked to see her in neurological
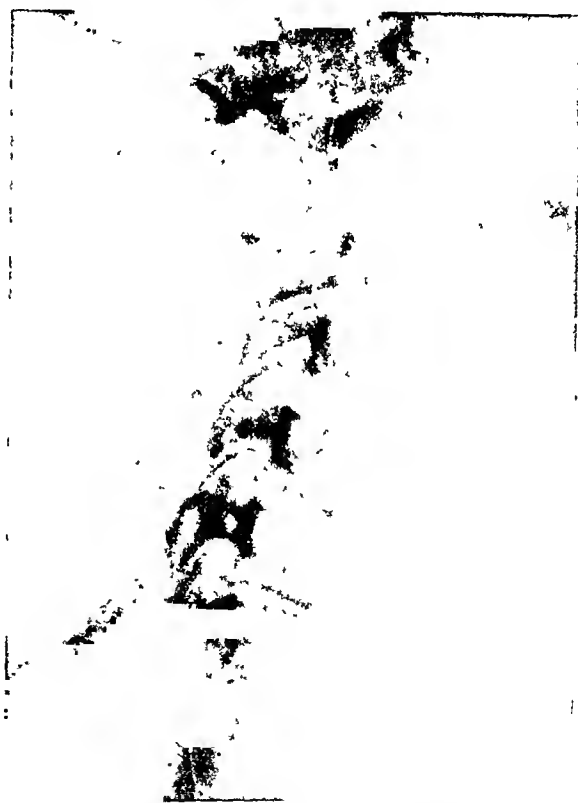
made (Figs. 7, 8). This showed considerable roughening of the articular surfaces of the sixth and seventh cervical vertebrae, particularly the sixth, the bone changes being more pronounced on the right side. There was also a considerable lessening of the space between the sixth and seventh cervical vertebrae.

Massage to the neck and hot and cold percussion douches were then given and complete

relief obtained in less than four weeks. There has been no recurrence except slight twinges of pain of which the patient makes no complaint.

CASE V. W. F. D., white, aged fifty, a railroad conductor who had been injured in a wreck twelve years before, complained of pain in the right hip joint, at times radiating down along the distribution of the right sciatic nerve. There was very little pain when reclining but the patient was unable to sit or stand because of the agony produced.

Six months before when the symptoms began he paid little attention to them. After three weeks he was forced to remain at home. He

Examination confirmed the patient's statements. A roentgenogram of the lower spine showed an old fracture of the fifth lumbar and first sacral vertebrae, with collapse of the former (Figs. 9, 10). Strangely, the symptoms referred to the fourth lumbar segment but this was probably because pressure was greatest against that root. The patient was hospitalized for treatment in a east.

CASE VI. G. S., aged twenty-five, complained of weakness in his legs. Two years before he had been seized in play by a fellow workman, following which he had a little lameness in his back. Some months later he
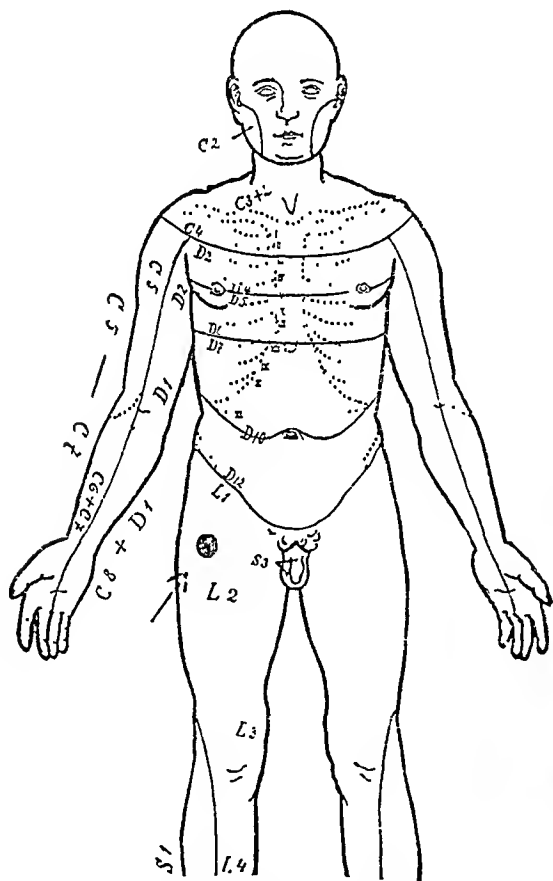
FIG. 9. Site of pain in Case V.

FIG. 10. Compression of the body of the fifth lumbar vertebra probably the result of an old fracture. Case V.

went to Hot Springs where he spent a month. After returning home her emained quiet a month and then had chiropractic treatments daily for another month. This seemed to relieve him at first but he soon developed so much pain that he was totally unable to work. There was no tenderness in the hip.

became weak as stated and this weakness progressed.

When examined he was found to have a sharp kyphosis in the upper lumbar region and unequal patellar reflexes, the right greater. Examination of the chest showed numerous medium and fine crackling râles in the upper third of both lungs. A roentgenogram of the lungs showed closely set flocculent shadows in

the same areas. Tubercle bacilli were found in the sputum.

A roentgenogram of the spine revealed some compression of the bodies of the first and second lumbar vertebrae with considerable increased bone density (Figs. 11, 12), which was more pronounced in the body of the second lumbar vertebra. The condition was characteristic of an old injury resulting in a compression of the bodies and some scoliosis with convexity to the left. The sacrum and right hip were normal. It was clearly a case of pulmonary tuberculosis with tuberculous spondylitis. The injury probably merely served to localize the lesion where the kyphosis later occurred.

Examination confirmed the absence of tenderness but the spine was found to be practically immobile. Roentgenologic study revealed an extensive roughening of the articular surfaces and a marked lipping of the borders of the lower dorsal and upper lumbar vertebrae. The bodies of some of the vertebrae showed partial destruction, particularly the seventh, eighth, and eleventh dorsal (Figs. 13, 14). The condition was characteristic of a high grade of osteoarthritis.

The patient was given careful stretching, massage and hot and cold percussion douches to the spinal region. After four days he enjoyed a night's sleep without pain and improved

FIG. 11. Site of kyphosis and tenderness in Case VI.
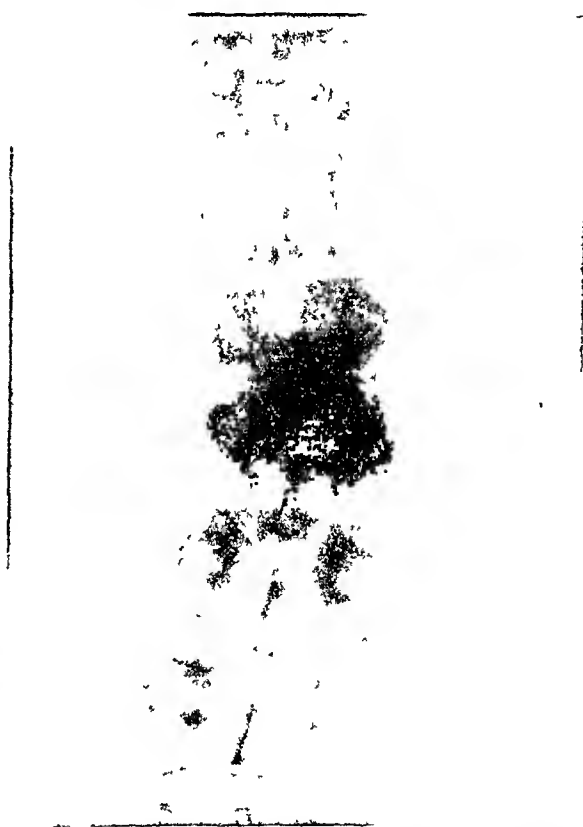
FIG. 12. Shows compression of the bodies of the first and second lumbar vertebrae with considerable increased bone density. Case VI.

CASE VII.   G. W., male, aged sixty-six, came complaining of severe pains about the chest and in his spine. He had not been able to sleep on his side for ten years but had never admitted to his family that he suffered. In walking upstairs he had often been observed to wince and show other signs of pain. There was no tenderness about the chest where pain occurred.

steadily for a month. He chose to remain at home for two days. When we again saw him he said he had not appeared because of a cold. His temperature was 104°F., pulse 130. He had bronchopneumonia and died of this four days later.

CASE VIII.   W. H. B., male, aged forty-six, undertook treatment because of an alcoholic

psychosis. He had so many delusions that no attention was paid to a complaint of pain in the right hip, which continued for five weeks during the early part of his stay with us. This pain occurred only on walking; he was entirely free when resting.

When his psychosis had partly cleared and we could obtain cooperation in our research, the area was carefully reexamined. There was no tenderness whatever in the right hip or leg but a sensitive area was found at the fifth lumbar vertebra. A roentgen-ray study of the lower spine showed definite bone changes. The fourth lumbar was displaced forward on the fifth about 2 cm., and there was some destruc-

his local physician who thought he might obtain surgery later.

It is not our purpose to distract from the well-established principles of medicine and present a new etiology for all pain, but rather to present the spinal etiology of obscure pain in its true light. For that reason we are recording the two following cases as a warning to be cautious.

CASE IX. Mrs. E. S., aged fifty-two, had been suffering for fifteen years with pain in the right arm and shoulder. There never had
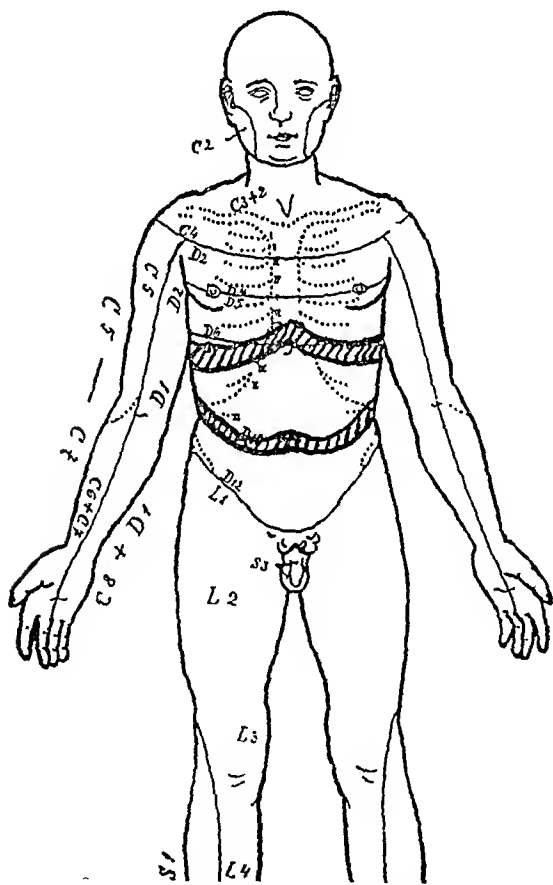
FIG. 13. Distribution of pain in Case VII.

FIG. 14. Shows a high grade of osteoarthritis of the dorsal vertebrae with a partial destruction of some of the bodies, particularly the seventh, eighth, and eleventh as indicated by arrows. Case VII.

tion of the upper surface of the fifth (Figs. 15, 16). There was also increased density of the bone around the superior and inferior articular processes. The appearance was typical of spondylolisthesis, probably the result of an old injury.

Surgery was recommended but refused. The patient left for home to be treated further by

been any tenderness in the afflicted area. She had consulted regular practitioners for years without results and then took osteopathic treatments with temporary relief. She next came under our observation.

A roentgenogram showed osteoarthritis of the seventh cervical vertebra (Figs. 17, 18).

A diagnosis of radicular irritation was made. The usual treatment gave complete relief in five weeks so that the patient was comfortable if she took considerable exercise and did not exposed herself to cold or damp weather. But this relief lasted only about six months when the old symptoms returned. At this juncture the case was restudied and referred to a medical consultant. In spite of previous careful examination of the sinuses and negative roentgenograms, the consultant insisted on a lipiodol study of the sinuses. Several drams of pus were found. When the sinuses had been cleared up, no recurrence of the symptoms was encountered.

relieved but was still present. She came to us for study and treatment.

Because the pain rapidly disappeared, we investigated the period of unconsciousness more carefully than we did the pain. Hatred of the husband was soon evident, based on a parentally forced marriage and brutal treatment by the husband over a period of years. A diagnosis of hysteria was made and the patient left after four weeks, apparently well.

In two weeks she returned, again complaining of the pain which had now spread to the outer side of the entire arm. A roentgenogram showed a normal shoulder, but with prominent lateral processes on the seventh cervical
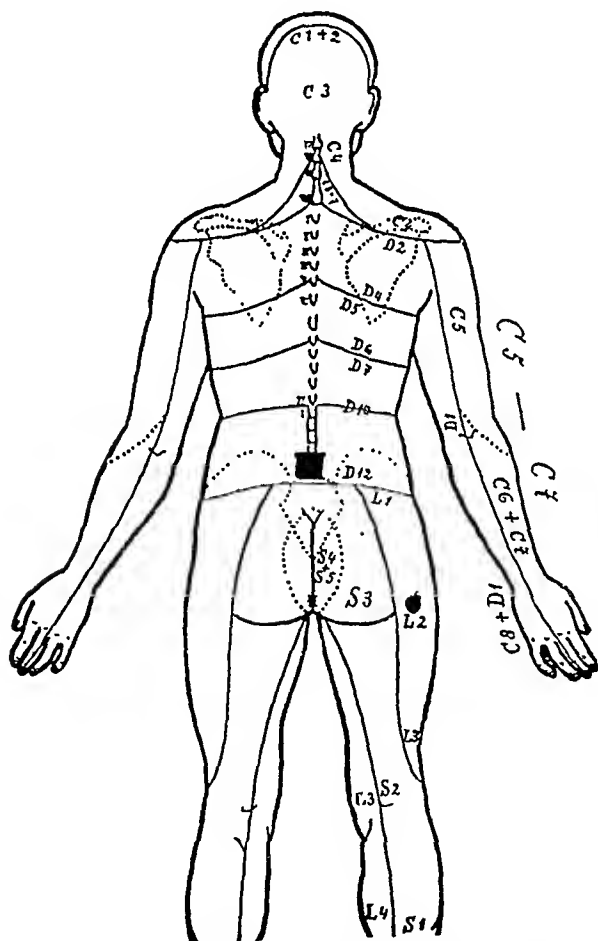
Fig. 15. Area of tenderness in the spine and pain without tenderness in the hip joint in Case VIII.

Fig. 16. Showing the body of the fourth lumbar displaced forward on the fifth about 2 cm., with some destruction of the upper surface of the fifth. Case VIII.

CASE X. Mrs. M. M., aged fifty-five, suffered from sudden lancinating pains in the region of the right deltoid insertion. After four days of terrific pain, she "lost consciousness and was delirious for three weeks." When she regained consciousness the pain was much

vertebra and signs of a mild arthritis (Figs. 19, 20). By this time there had been developed a marked limitation of motion of the shoulder joint which was entirely relieved by pressure over the deltoid insertion. A diagnosis of bursitis was made and treatment directed to this condition. Ankylosis of the shoulder joint

was looked for but was not present. Following the extraction of four infected teeth, there was a terrific flare-up of pain in the entire right arm which did not subside for ten days.

During this time the patient was of necessity kept quiet and when she was again able to be up another examination revealed complete fixation of the shoulder joint. This complication was treated in turn by radiant heat, diathermy, hydrotherapy and massage. The spine was similarly treated, and in three weeks about 60 per cent mobility was obtained. This was improving rapidly when the patient left, practically well.
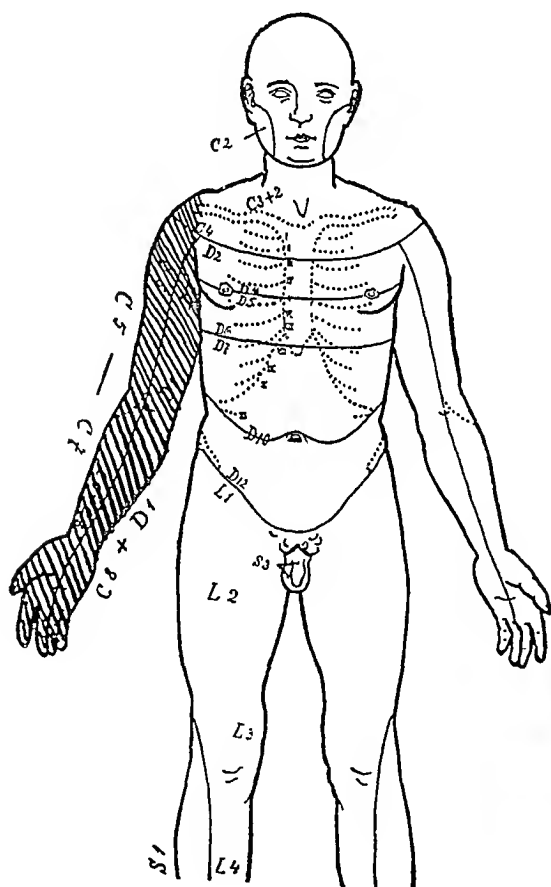
original cause of the arthritis should be found and removed if possible.

COMMENT

In referred pain the neurologist should be of considerable aid in the localization of pathology by tracing skin areas or individually involved muscles to the corresponding segment of the spinal cord, thus suggesting the segment of the spinal column in which the pathology of referred pain should be found. Unless there is shown a definite relation between spinal

FIG. 17. Distribution of pain in Case IX.

FIG. 18. Osteoarthritis involving the seventh cervical vertebra in Case IX.

column pathology and the site of pain, an arthritis of the column must not be assumed to be the cause of the pain. Even when the association mentioned definitely exists, mistakes are possible. Because of this, the neurologist collaborates with the radiologist, the former stating where the spinal column pathology must be (if it is the cause of the pain), the latter inde-

These two cases serve to emphasize that
1. All pain is not necessarily due to an arthritis even when this is present.
2. Two or three concomitant diseases may occur.
3. The focus of infection which is the

pendently stating where the pathology (if any) actually occurs.

Atrophy or fibrillary twitching of muscles is often a good guide to the spinal lesion. Pain alone is less reliable but objective changes in the skin sensibility are of extreme importance.

SUMMARY

1. A series of cases has been presented to demonstrate the value of roentgenography in the diagnosis of the cause of referred pain.

2. Cooperation between roentgenologist and neurologist is necessary for the accurate determination of the causal relationship between spinal column lesions and referred pain.

3. Neuritis, neuralgia and toxic effects of infection must be carefully considered in arriving at a diagnosis.

4. The radicular cause of pain is far more common than usually suspected.
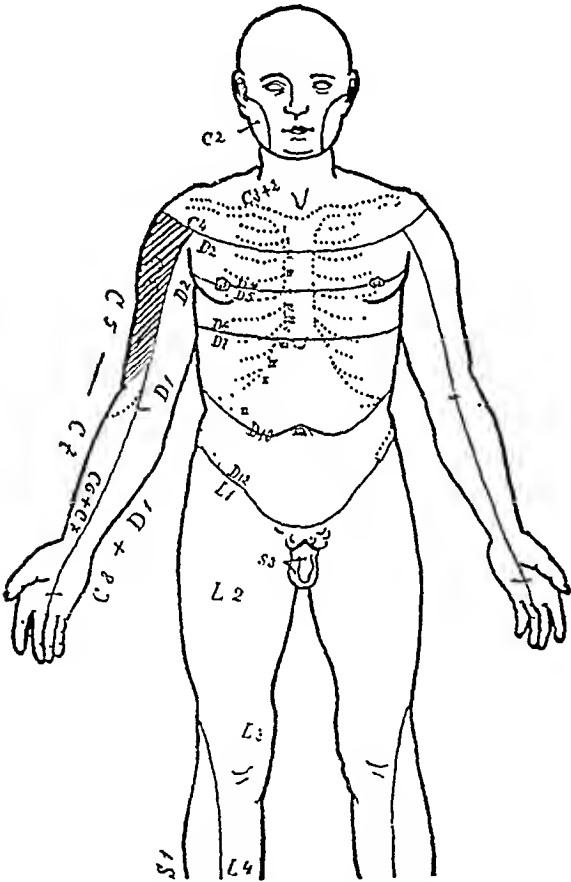
FIG. 19. Distribution of pain in Case x.

FIG. 20. Note prominent lateral processes on the seventh cervical vertebra and signs of a mild osteoarthritis. Case x.

CIRCUMSCRIBED FALSE
PERIPHERAL NEUROMATA
REPORT OF TWO CASES

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THIS communication deals with solitary tumors of peripheral nerves, of a type usually described as false neuromata, neurofibromata, or neurofibromyxomata. Though this type of tumor sometimes undergoes malignant change, the cases we discuss fall under the class considered benign. The malignant tumors of this group are of the sarcoma type. The differentiation between a benign false neuroma and one which has undergone malignant change is apparently not easy to make.

The term neuroma should be reserved for true nerve tissue tumors with ganglion cells present, containing nerve fibers, sometimes medullated. A. Thompson[1] in 1900 said that there were only five authenticated cases on record. They are innocent, usually originating from the abdominal sympathetic nerves, sometimes in the subcutaneous tissue, and are to be differentiated from neurofibromatosis.

The solitary, circumscribed false neuroma is usually fusiform, arising from the nerve sheath. A tumor large enough to attract attention may spread out the nerve fibers, though rarely the nerve fibrils pass through the tumor. The long axis of the fusiform tumor coincides with the long axis of the nerve to which it is attached. The tumor is usually smooth, rounded, encapsulated, movable laterally but not up and down, and tends to undergo myxomatous degeneration, which later on, especially in the larger tumors, may result in the formation of cysts, single or multilocular. These false neuromata vary greatly in size; Kerr[2] described what he thought to be the largest fibroma on record, a pure fibrous tumor arising from the sciatic nerve, weighing 1 pound, 3 ounces and measuring 6 by 3 inches. They are rare, circumscribed, and occur in the course of a nerve which presents no other pathological change.

It is believed that the sarcomatous tumors of this group are not primarily malignant but are the result of malignant degeneration of benign tumefactions.

They may occur at any age, but are most commonly encountered in the third and fourth decades. In fifteen cases where the sex is stated, there were eleven males and four females. The youngest was seventeen, the oldest was eighty.

Any nerve may be involved. The most frequent location is the sciatic nerve. In analyzing twenty-six cases of solitary nerve tumors (the two we are reporting and twenty-four which we have been able to find in the literature), the location of the tumor was as follows: sciatic nerve, seven cases; brachial plexus, five; ulnar nerve, three; median, tibial, cervical and musculospiral nerves, two each; and popliteal, internal cutaneous and anterior crural, one each. This is contrary to previous published statements that the median nerve is the most frequent site of benign solitary tumors.

Flatau and Sawicki[3] have reported a very interesting case of an enormous neurofibroma found at autopsy, the tumor involving the second and third cervical nerves. They also cite cases reported by Dowse,[4] Heurteaux,[5] Zinn and Koch,[6] Boerner,[7] and Bing and Bircher,[8] all of which were instances of neurofibromatous type of tumor of intraspinal origin as was probably also the case reported by Flatau and Sawicki.

In general they are very likely to be

sensitive, although some cases are recorded where the lack of sensitiveness led to failure to make a correct preoperative diagnosis. There is rarely any loss of motor or sensory power of the nerve involved in an innocent nerve tumor; even in the most severe cases the symptoms are variable, usually

FIG. 1. Roentgenogram of left leg showing normal bony structure, and a soft tissue tumor (at arrows) between bones and Achilles tendon, the tumor causing definite local displacement of calcareous posterior tibial artery.

consisting of tingling and "pins and needles" sensation along the sensory distribution of the nerve.

The etiology is not well known. Trauma is usually considered as the chief factor in the production of discrete neuromata and yet a history of definite injury over the member, the site of the neuroma, is not often obtainable. However, it is a fact that these circumscribed tumors are usu-

ally located in some exposed position, easily and frequently subjected to repeated trauma of a relatively mild nature not sufficiently painful to attract one's attention. The two cases reported by Fleming and Marvin[9] both gave a definite history of injury. These were both large tumors of
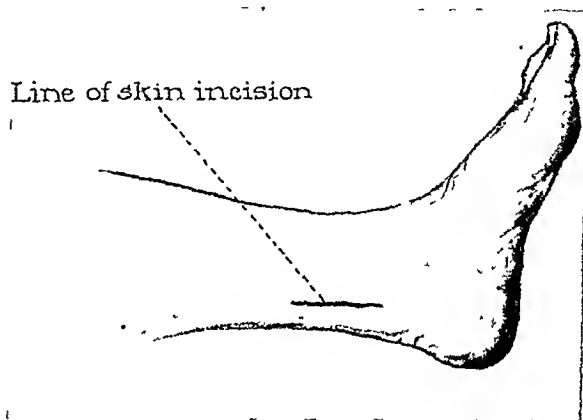
FIG. 2. Line of incision for enucleation of tumor of posterior tibial nerve, just above malleolus.

the sciatic nerve, almost the size of a man's fist. Fleming and Marvin also brought out the striking fact in their cases that the patients were brother and sister. Their report is the first to suggest the existence of a hereditary tendency toward the formation of discrete false neuromata.

Benign nerve tumors grow very slowly. In most cases the patient has been aware of the tumor for years. Sometimes a tumor will exist for a long period without any apparent change in size and then undergo sudden and rapid enlargement. In other cases the growth is very gradual over a period of years. In Gatch's[10] first case, the tumor exhibited gradual growth during eleven years until it reached the size of an English walnut and then in one year attained the size of a hen's egg.

Since these tumors may undergo malignant degeneration, there seems to be a real danger in postponing operation indefinitely, especially when they are associated with sensory or motor nerve disturbances. In favor of a benign growth are absence of motor or sensory paralysis and long dura-

tion. Gatch's first case, as well as Linell's[11] and several others, demonstrate that even sudden and rapid growth in a tumor which has existed for years without enlargement, does not constitute positive proof of malignant change. In several cases, including one of ours, the pain was extraordi-

Later, there was found a large inguinal mass which on removal proved to be a sarcoma of the lymph glands.

If the tumor is encapsulated and easily shelled from the center of the nerve trunk, the probability of a benign growth is indicated. On the other hand diffusion of
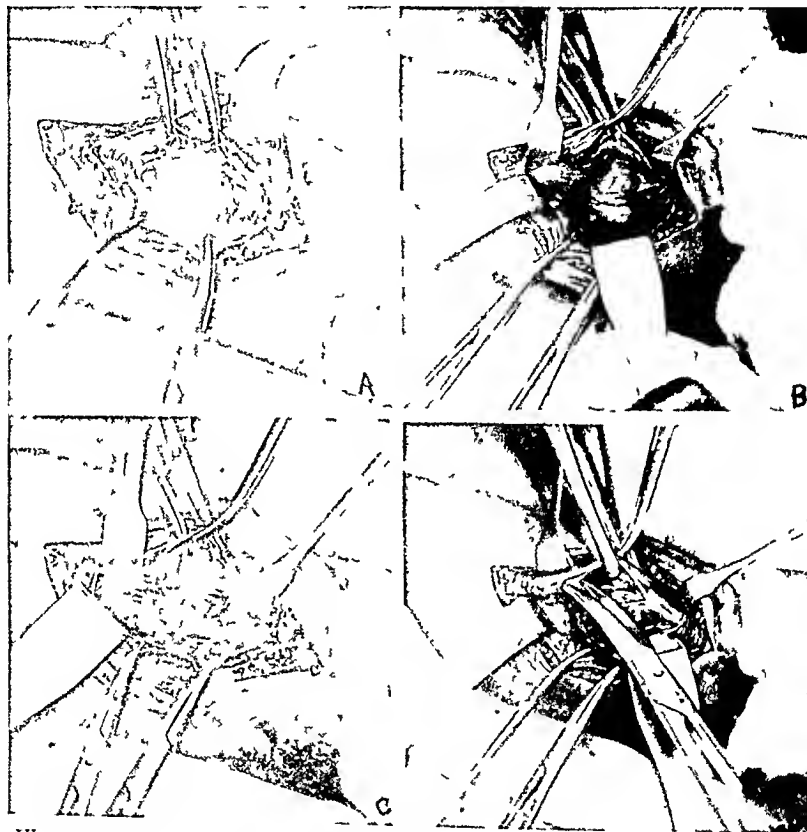
FIG. 3. Illustrating various stages of enucleation of a tumor of the posterior tibial nerve.

narily distressing; yet nothing in the gross or microscopic appearance of the tumor suggested malignancy. Even at operation it may be very difficult to determine the innocence or malignancy of one of these growths.

MacArthur[12] has published an interesting case of sarcoma of the posterior tibial nerve in which from the history the tentative diagnosis was a benign neuroma. At operation it was found that the tumor terminated above and below in a polar elongation. The nerve trunk was obliterated in the tumor substance. MacArthur resected the nerve trunk with the tumor.

the tumor without encapsulation and fixation to the neighboring tissues strongly suggests sarcoma. A detailed study of the reported cases indicates that the microscopic study of the tumor should not be relied upon to the exclusion of other evidence. The conclusion is warranted that if the surgeon is in doubt as to the nature of a solitary tumor of a peripheral nerve he should treat the lesion conservatively, especially if its removal involves the possibility of permanent impairment of motor function. In most benign tumors one can enucleate the tumor, preserving the nerve fibers with very slight permanent

impairment of the nerve and very slight probability of recurrence following such a conservative procedure.

CASE I. Mr. R. W. (103–161), aged eighty, was referred May 28, 1916, by Dr. C. C. Hubly for treatment of a small tumor on the left arm. There was no history of trauma or disease of

the arms the superficial veins were very large. The tentative diagnosis was an old hematoma, lipoma or some other benign connective tissue tumor, or a possible neuroma of the musculo-spiral nerve.

Operation, June 1, 1916 (J. T. C.), under local anesthesia. Incision 7 cm. in length on
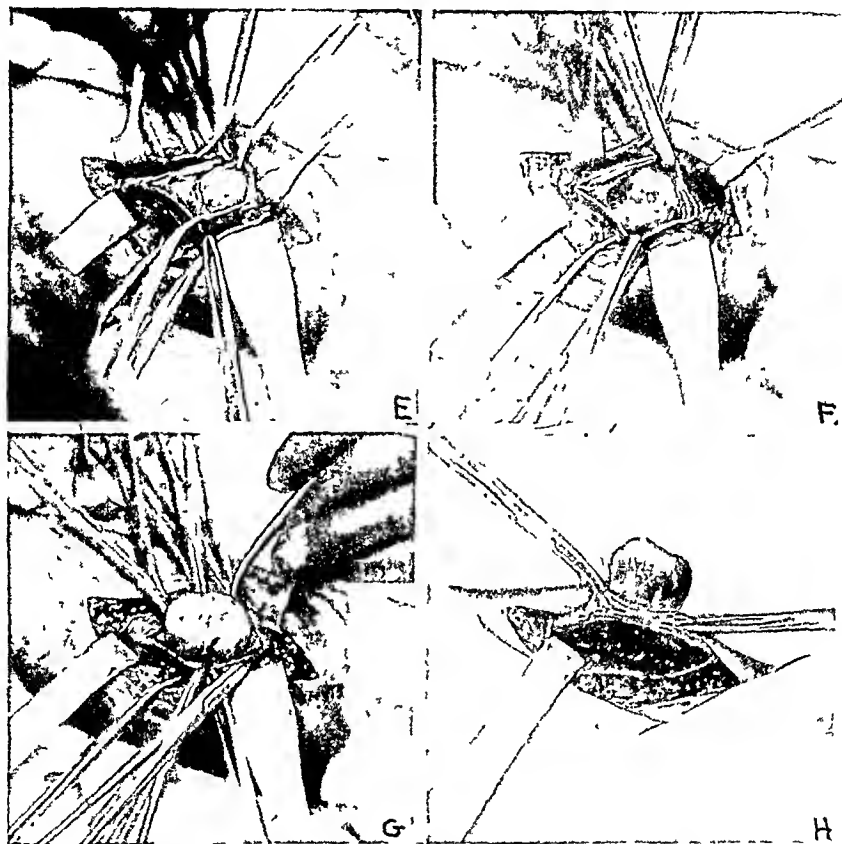
FIG. 4. Illustrating further stages of enucleation of tumor of posterior tibial nerve.

the left arm or shoulder or of the cervical vertebrae. The patient was not aware of a similar growth in any member of his family. He consulted us simply because for years he had noted a small movable tumor on the outer side of the left arm, 4 or 5 cm. above the elbow, and because pressure over the tumor caused pain radiating down the arm. There were no enlarged axillary glands and no pulsation over the tumor. Mobility was free laterally but not up and down. There was no subjective pain except when by accident the tumor was compressed, and no motor or sensory disturbances in the forearm or wrist. Since the tumor was movable, it was not thought necessary to make a roentgenogram. The patient was subject to varicosities of both legs and even in

the outer side of the humerus, parallel to the brachialis anticus muscle. On exposing the musculospiral nerve, it was found to be the seat of a fusiform swelling tapering off into normal nerve above and below the tumor, the nerve fibers spreading out around the mass. After opening the nerve sheath by a longitudinal incision, the nerve fibers were carefully lifted aside with practically no injury to the nerve, and the mass enucleated without difficulty. The incision in the nerve sheath was approximated by one or two fine sutures of plain catgut and the wound closed in two layers with absorbable suture. Healing per primam. There was no subsequent distress of any consequence and no motor disturbance.

The patient visited the institution on several

later occasions for the treatment of pernicious anemia, of which he finally died at the age of eighty-six.

The pathologist said the tumor exhibited a loose cellular structure containing a large number of lymph spaces. Microscopically the neoplasm consisted largely of dilated lym-
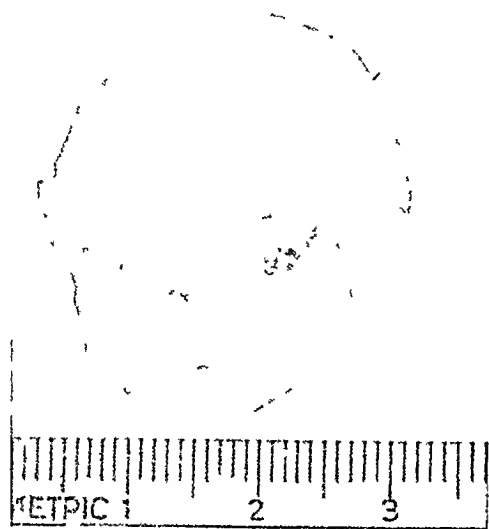
FIG. 5. Photograph of enucleated tumor.

phatics apparently in nerve bundles which were more or less typical. The growth was classified as a lymphangioneuroma.

CASE II. Mr. A. P. (199–077) aged sixty-three, locomotive inspector, was admitted August 8, 1927, for relief of nervousness, insomnia, constipation, and especially for treatment of neuritis involving the left leg and foot. During the past fifteen years the patient had suffered from neuritis of the left ankle and foot with some remissions but never complete relief. The foot was very sensitive to changes in the weather. On the left leg just above the ankle, more evident on the internal aspect of the member, was a rounded swelling about 2 cm. in diameter, somewhat movable laterally but not in the longitudinal axis of the leg. It was not attached to the skin. Neither was it sensitive to gentle pressure, but pinching or hard pressure caused intense pain shooting into the foot. The pain was described as a burning, especially in the sole of the foot. No pulsation could be detected in the tumor and there were no large inguinal glands.

The lump was first noticed about twenty years before admission and was much smaller then than it is now. His attention was called to it by pain in that region, the distress being increased by pressure. He had always suffered a varying degree of pain in the left ankle and foot, involving particularly the middle third of the sole of the foot. About twelve years ago the symptoms increased in severity and the lump began to enlarge. Lately the local condition seemed to influence his general nervous state, aggravating it considerably. Although several physicians had advised him to pay no attention to the lump and its attendant symptoms, the patient was convinced that it had been the real cause of his nervousness and general neurasthenic state. There was a distinct limp when walking. The blood Wassermann test gave a negative reaction.

Roentgen-ray study (Fig. 1) failed to reveal any abnormality of the bones of the leg or ankle, but it did show distinctly the presence of a tumor between the shadow cast by the Achilles tendon and the bones of the leg, causing a distinct local displacement of the neighboring calcareous artery, this shadow corresponding definitely to the palpable painful tumor.

Tentative diagnosis: Neuroma of the posterior tibial nerve.

Operation, August 18, 1927 (J. T. C.), under local anesthesia. The posterior tibial nerve was exposed through a longitudinal incision on the inner side of the left leg just above the ankle (Fig. 2). It was found to surround a well-encapsulated, fusiform tumor about 3 cm. in diameter (Fig. 3, A, B, C). The nerve was of apparently normal structure above and below the tumor. The sheath of the nerve was split longitudinally (Fig. 3, D), and the fibers spread to one side or the other, as seemed most convenient and most likely to produce a minimum of traumatism, until the tumor itself was exposed and enucleated (Fig. 4, G, H). It was necessary to inject some novocain into the nerve itself before proceeding with the enucleation of the mass, which was seen to grow from the sheath of the nerve on its anterior external aspect. The tumor measured 2 cm. in diameter. The sheath was then lightly sutured with three plain No. 00 catgut sutures and the wound closed. Immediately at the termination of the operation, twenty-five minutes after the injection of novocain into the nerve itself, the patient was able to perform all

normal movements of the foot and toes in all directions. For several days there was great subjective pain just as before the operation but somewhat exaggerated. Radiant heat and diathermy afforded the most marked relief. Convalescence was greatly retarded by the patient's exceedingly nervous and despondent state. However, a letter from him, dated April 1, 1928, makes it clear that he has almost completely recovered normal sensory function in the affected ankle and foot.

The pathologist's report on the tumor follows: The tissue shows nearly a pure neuroma in areas; other areas show neuoglia. No ganglion cells found, although there are atypical neuroblasts. Nerve fibers are chiefly non-medullated. Throughout the tumor there are large and atypical lymphatics and blood vessels. Some blood vessels show some hyaline change in the walls, cylindromatous change. There are also areas of myxomatous tissue scattered throughout the growth and some pigmented areas from old hemorrhage. The general structure is that of a congenital disturbance of development resembling the cirsoid neuroangioma.

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TONSILLECTOMY

UNDER LOCAL ANESTHESIA

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THE tonsil operation technique adopted in the clinic at the Battle Creek Sanitarium exemplifies the best points from the work of such men as Matthews of Rochester, Canfield of Ann Arbor, Boot of Chicago, Fisher of Cleveland and King of New York. The plan of operation which appealed most to us after careful observation of the work of these and other surgeons was removal with a wire snare following careful dissection of the tonsil close to the so-called capsule. This is still the method of choice in our clinic (Fig. 1).

As a preliminary to each operation a blood coagulation test is made. One of our most distressing experiences came a number of years ago before this test was introduced. At that time inquiry was, however, made about each patient's tendency or history as to bleeding. A physician who had marked arthritis and obviously diseased tonsils was brought for operation by a member of our staff. Neither physician mentioned any bleeding tendency and, being himself a physician, the patient was asked no questions. At operation and for three or four hours afterward, he bled quite alarmingly. Later he stated that a few weeks previous he had had a severe hemorrhage from or into his urinary bladder.

The possibility of a change in coagulation time or bleeding time is illustrated by a case in the practice of a colleague. A patient desired a plastic operation on the skin below her chin. This surgeon had performed two major operations on her within two years preceding without troublesome bleeding. Following the plastic operation the surgeon and his associate spent six or seven hours applying digital pressure over sponges along the line of incision to stop persistent capillary oozing. The coagulation time when tested the next day was forty-five minutes.

Routinely morphine sulphate $\frac{1}{8}$ grain with atropin sulphate $\frac{1}{150}$ grain is given hypodermically about thirty minutes before the patient enters the operating room (Fig. 2). In any case in which there is contraindication to opium alkaloids the atropin alone is given. When indicated by the nervous instability of the patient, a more profound effect is induced by H.M.C. tablets No. 2 containing hyoscine hydrobromide $\frac{1}{200}$ grain, morphine hydrobromide $\frac{1}{8}$ grain, cactoid $\frac{1}{120}$ grain, or by double that dose as contained in the H.M.C. tablet No. 1.

No cocaine is used either topically or by infiltration. A 1 per cent solution of novocain is used, slightly colored with methylene blue. The three fatal cases under local anesthesia preparatory to tonsillectomy that have come to our attention have all been due to a mistake in the solution percentage, either in the drug room or in the preparation room. One of these fatalities occurred at a military hospital, one in a university clinic and one in a physician's office. Either $\frac{1}{10}$ of 1 per cent or 1 per cent solution of cocaine was intended, and 10 per cent solution was used. In our clinic 1 per cent cocaine was used unintentionally in one case instead of 1 per cent novocain. Immediate discovery of the substitution and prompt removal of the tonsil with escape of a large amount of the infiltrate prevented unfortunate results. Following this the surgical nurse proposed a color identification of the solution to be used for infiltration. The pharmacist suggested a trial of methylene blue. This has

been very satisfactory, not only as an insurance but as an indicator. The color contrast between the blue infiltrate and the pink tissues shows very clearly where and to what degree the anesthesia has been extended. Into one ounce of the 1 per cent solution of novocain are dropped 5 minims of epinephrin. Usually more than

FIG. 1. Instrument table with solutions and supplies.

one-half and less than three-quarters of the ounce is used on the two sides.

Besides the above experience with 1 per cent cocaine in place of 1 per cent novocain, we have had only one other unfortunate occurrence. We have in stock a large bottle of sterile saturate solution of sodium chloride. From this the pharmacy prepares easily and as needed the normal saline solution which is the solvent for various medicaments. On this occasion the full strength mother solution of saline was used instead of the diluted normal saline solution. This solution was used for one patient by one surgeon, and by a second surgeon in one case for both tonsils and in another case for one tonsil. The patients complained of pain at the time of injection, the tissues turned at once a peculiar purple color, and later there was superficial sloughing of the tissue overlying the muscles of the fossae. No secondary hemorrhage ensued, however, and the final appearance of the faucial pillars was quite good. We considered ourselves fortunate not to have injected the solution intramuscularly.

A small superficial area of infiltration is

made in the submucosa of the anterior and posterior pillars (Fig. 3). This insures surface anesthesia. Then about one-half a dram of solution is introduced deeply into each of three sites. The first is through the loose membrane covering the supratonsillar fossa so as to fill the space above and behind the head of the tonsil. The
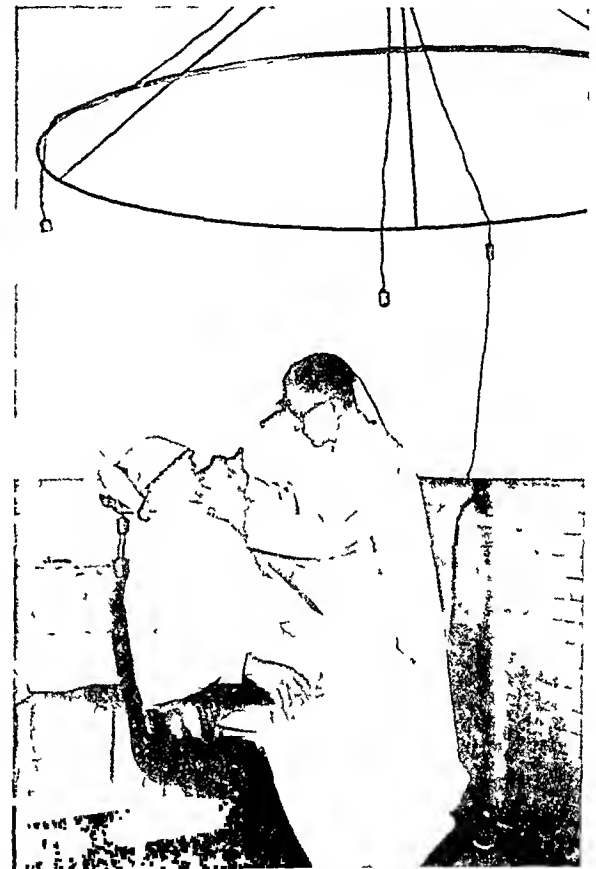
FIG. 2. Patient in operating chair showing overhead ring to carry light cord behind operator in all positions.

second is downward and inward just in front of the posterior pillar near the lower pole. The third is downward and backward through the plica triangularis just anterior and below the tonsil. From three to five minutes delay before operating insures hemostasis and anesthesia.

The primary incision is a small nick or puncture within the triangular loose membrane high between the pillars and just over the front edge of the tonsil crown or head (Fig. 4). This is a dry wound, and exposes the glistening outer surface of

the tonsil head. By this exposure the postoperative relation of the pillars above is insured and a proper approach for the following dissection made easy. In making this nick the tonsil is tugged a bit downward and toward the midline of the throat. This makes the triangle of approach quite evident and tenses the mucosa to the knife.
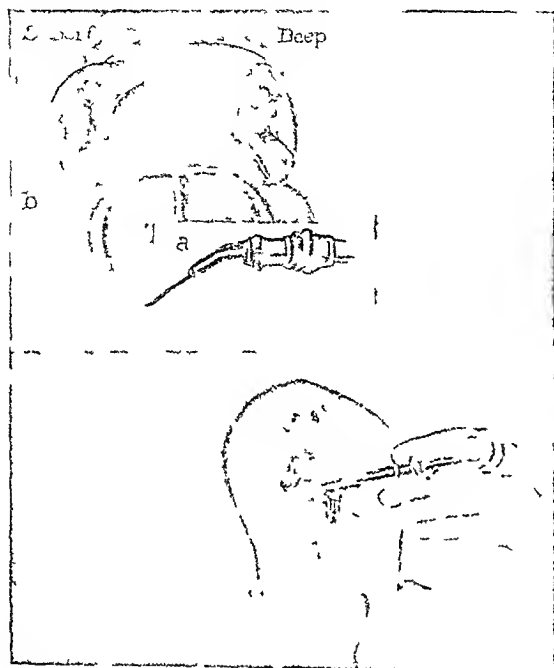
FIG. 3. Superficial infiltration on right side, deep infiltration on left; Lilly syringe.

In trying various tonsil seizing forceps, we found none that suited the needs so well as the Allis forcep used in abdominal surgery. Mueller has modified this by adding 1¼ inches to the length of the shaft between the lock and handle and by making the teeth a bit longer.

The secondary incision, or the circumcision of the tonsil, follows (Fig. 5). A blunt-ended, curved knife is introduced into the submucous plane of each pillar in turn. The point of the blade insinuates itself down as low as the tonsil extends. The sharp edge is now turned backward on the anterior pillar and forward on the posterior pillar. The membrane is gently loosened from its attachment to the tonsil rather than cut through. This spares as much of the mucosa as possible

to act as a covering of the inner surfaces of the pillars. There is less bleeding from such an edge than would be from a cut edge. By these incisions nearly one-quarter of the anterior and one-quarter of the posterior surface of the tonsil is at once exposed.

The remaining dissection of the tonsil is now performed (Fig. 6). This may be
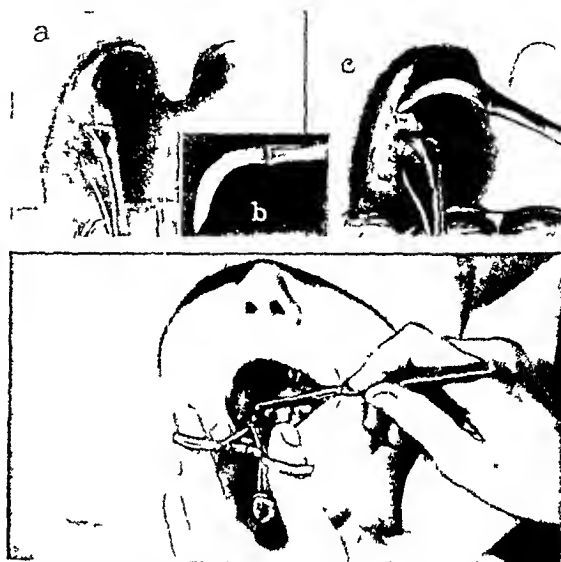
FIG. 4. Primary incision; (a) tonsil seized and mucosa tensed; (b) pointed sickle knife; (c) mucosa being nicked.

done with scissors or the golf-stick serrated dissector. In secondary tonsillectomies or in cases where retrotonsillar scar tissue has followed peritonsillar abscesses, dissection may be done with either the scissors or the sharp edge of the golf-stick dissector. The use of the scissors is often easier and to be advised. As the tonsil is loosened backward one comes to a sort of membranous structure that resists progress of the dissection. This is true also as one dissects forward from the posterior pillar. If a little care is exercised, these two membranes are found to extend from top to bottom of the tonsil at its most external part and to be separated from each other by about 2 or 3 mm. This structure is of surgical significance and importance. The dissection up to this point is usually bloodless. Now if this resisting structure is loosened or cut, practically always there is definite bleeding at once. These two

membranous sheets are the sides of a tube between the fascia over the superior pharyngeal constrictor and the body of the tonsil, like a fin or a mesotonsil. Between these tough membranes the space is filled with loose areolar tissue and blood vessels. Within this tube the principal surgical blood supply runs down behind

Fig. 5. Second incision, circumscribing tonsil and loosening mucosa at its attachment to tonsil.

the tonsil. The larger arteries run external to the superior constrictor. The smaller vessels then pass over the upper border of this muscle and run down behind the tonsil within this fin as mentioned. As the arteries pass downward lateral branches are given off and penetrate the tonsil mass.

A similar tough band of connective tissue is encountered in freeing the anterior pillar and plica triangularis from the lower pole of the tonsil anteriorly. This indicates the course of the blood vessels coming in to the tonsil fossa from the lingual blood supply.

In opening the supratonsillar fossa and in peeling the tonsil downward from one to several mucous glands are usually revealed. It is our custom to seize and remove these

by the tonsil forceps. In some of our own cases and in other cases coming to the clinic, we have seen these flat superficial mucous glands hypertrophy and appear as lenticular masses in the depth of the fossae. On occasion these glands may become inflamed and greatly worry the patient. Also a physician examining the
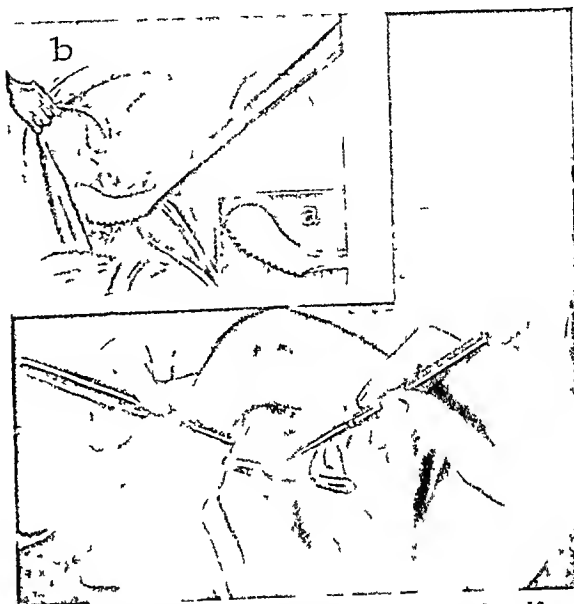
Fig. 6. Dissection with serrated edge of golf-stick knife, keeping very close to surgical capsule.

throat may decide that these inflamed masses are tonsil remnants unfortunately left by the former operator. While such a conclusion and opinion should not be reached, the removal of the mucous gland is to be advised. One German observer claims that he has seen "retrotonsillar" abscesses appear at a time long subsequent to the complete removal of the tonsils, originating in fact from the infection of mucous glands that had been allowed to remain in the fossa.

The lower pole of the tonsil being entirely loosened and exposed anteriorly and the mucosa being dissected down to the extent of the tonsil posteriorly, the tonsil is now removed with a Tydings snare (Fig. 7). The stylet is placed just behind the anterior pillar as low as possible.

In our early experiences the question of what to do with the plica triangularis

was a difficult one to answer. Matthews in those days advocated its complete removal and the dissection of the lymph follicles extending down the pharynx for a short distance below the tonsil. Canfield on the other hand opposed this idea, urging that the plica be conserved. He maintained that the complete removal of

FIG 7. Removal with Tydings snare. Mesotonsil not completely dissected. In operating dissection is carried considerably further downward.

the plica would often result in a cicatricial binding of the anterior pillar and the tongue, with discomfort and dissatisfaction to the patient. It has been our custom to remove that portion of the plica, if any, that contained prominent lymph follicles and mucous glands. In doing this, we endeavor to retain the attached border and as much of the free plica as is not involved in this gland mass. Occasionally we have observed hypertrophy of the plica mass when the glands were not removed. A few times we have seen this mass drawn in to the fossa and bound down near its lower pole, simulating in appearance a tonsil remnant.

Routine ligation of the superior or principal blood supply is performed (Fig.

8). The needle holder was originally fashioned from a Schnitt gall-bladder forceps. A cut or groove was filed parallel to the course of jaws in the mid-line of the blades. This holds a modified perineal fish-hook needle which has been annealed. The loose connective tissue remaining from the mesotonsil is picked up by the
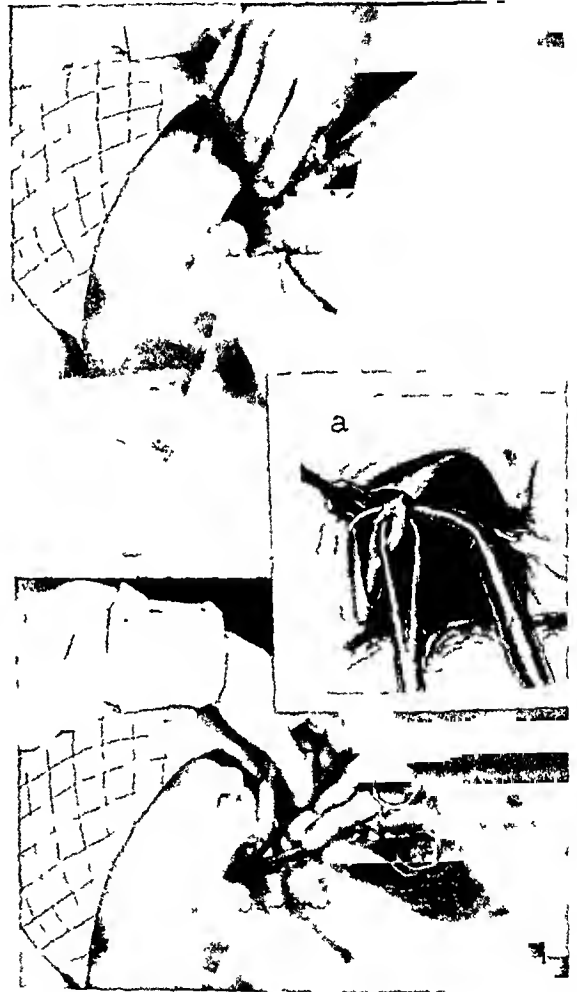
FIG 8. Inserting ligature through mesotonsil or fin bearing principal blood supply.

forceps high in the fossa. Slight traction is made, and the rather blunt pointed needle is slipped between this areolar tissue and the muscle fascia, carrying a No. 000 silverized catgut ligature. This catgut is of fine calibre and high visibility, being black, and has excellent tensile strength. It absorbs as would plain catgut. The proof of the circulation is established

by this ligation. One may note a point or two of bleeding part way down the fossa. If the point is directly seized with a hemostat and ligated, one might feel that the vessel penetrates the muscle bed and enters the fossa at a right angle to the tonsil. This is not true. Arteries do not pierce muscles to get to and supply some other structure. The course is around the edge of the given muscle. This is true here. The vessels come over the upper edge of the pharyngeal constrictor muscle, pass down behind the tonsil and give off branches that enter the tonsil (Fig. 9). As noted above, this is shown conclusively by ligating the vessel mass high in the fossa, and observing that a bleeding point one-third or one-half way down the fossa stops at once. Occasionally the lesser supply from the lingual region has to be ligated also. This necessity is usually occasioned by carrying the dissection too far away from the tonsil capsule. If the dissection hugs the tonsil, the vessels are divided where they are small and as a rule do not bleed. If necessary to ligate the vessels from the lingual region, the tissue just behind the plica and low in the fossa is seized and surrounded by a ligature on the needle.

After the fossa is dry it is very lightly wiped with an astringent solution consisting of equal parts of glycerine and Monsell's solution, with 2 drams of tincture of iodine to 12 ounces of the mixture. This induces a capillary coagulation that opposes even slight oozing when the epinephrine effect passes off and when the patient clears his throat or swallows. On occasion one may insufflate a fine coating of a powder containing two parts of bismuth subnitrate and one part of anesthesin. This also is for the purpose of establishing an early superficial coagulum especially in patients with high blood pressure or in highly nervous patients.

In our clinic the patient is under the direct supervision of the Department of Otolaryngology for the forty-eight hours following the operation. He is immediately put to bed and the following routine employed:

First Day.

1. Have radiant heater in bed before the patient enters the ward.

2. Patient should be in Fowler's position, reclining at night if desired. Ice bags to throat for two or three hours, according to patient's comfort.

3. Begin water drinking three hours after operation, 8 oz. every hour.
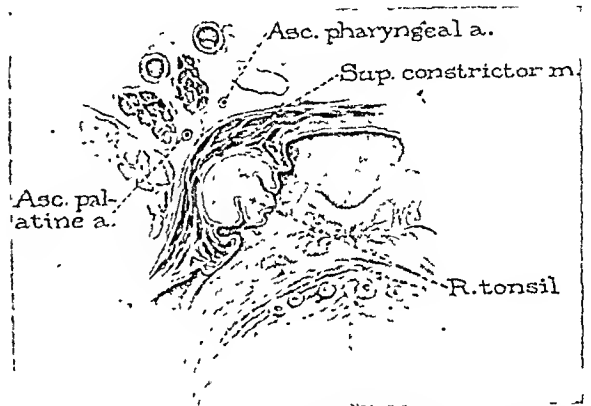
Fig. 9. Relation of main arteries behind and branch arteries in front of superior pharyngeal constrictor.

4. Give atropine grain $\frac{1}{150}$ for excessive flow of saliva. Repeat every three hours if necessary. To be given by mouth or hypodermic.

5. For headache, earache or extreme sore throat, give aspirin grain 5, and codeine grain 12 as required and repeat in two hours if necessary. Use 3 drops of 5 per cent phenol and glycerine in ears for earache.

6. No food until evening. Ice cream and bland fruit juices to be given then.

7. No talking, clearing of throat or gargling the first day.

Second Day.

8. Continue water drinking every hour.

9. Gargle five times daily with hot normal saline solution ($\frac{1}{2}$ teaspoon to 8 oz. of water). Gargle morning and evening and after meals.

10. Order enema if necessary.

Third Day.

11. After breakfast send tonsillectomy patients in wheel chairs to Nose and Throat Department for treatment. Instruct each patient to gargle throat five times daily and drink water. This concludes the patient's ward care completely unless otherwise instructed by surgeon.

There is a possibility of bleeding in each of three periods. First, at the time of operation. This is controlled by the epinephrin in the novocain solution, by the careful and close-to-the-tonsil dissection, and by the immediate placement of the ligatures.

Second, during the first four or five hours following. This is incidental to the wearing off of the epinephrin effect and to the repeated clearing of the throat by the patient. In most cases there is a little tinging of the mucus with red. As a rule the reassuring of the patient is sufficient. Occasionally the oozing results in the formation within the fossa of a clot which may project or hang into the pharynx. The presence of the clot annoys the patient and induces him to continue the clearing of his throat. The clot itself may hold the tissue crevices open and keep the capillaries oozing. Usually the simple complete removal of the clot causes the capillary oozing to stop at once. Occasionally a touch of 8 per cent nitrate of silver, a drop of Monsell's solution or a few grains of astringent powder may be needed to cause the formation of capillary coagulation. Quite infrequently a definite bleeding vein manifests itself an hour or two after the operation. This requires a ligature.

Third, the so-called secondary hemorrhages occurring about the fifth day, or between the fourth and eighth day. This is surprising to the patient but is not usually of any severity or seriousness. Here again the thorough removal of the clot, especially the last little portions at the actual site of oozing, will cause prompt cessation. A touch of silver nitrate may be needed. We have not experienced a secondary hemorrhage requiring ligature.

The nurse in charge of the operative case is given the following suggestive outline:

HEMORRHAGE

1. Non-important:
     Streaked mucus expectoration.
     Occasional clot.
     Notify surgeon on evening call.
2. Important:
     Repeated expectoration of clots or fresh blood.
     Notify head nurse during day and night physician at night.
3. Urgent:
     Repeated swallowing.
     Flow of blood from mouth.
     Notify head nurse during day and night physician at night and if neither can reach ward promptly call patient's surgeon.

Calmness is imperative. Avoid confusion. Keep patient's bed clean and in order.
Give patient a hypodermic injection of ¼ grain of morphine sulphate unless one has been given within the last hour.
Do not leave immediate vicinity of patient.

On the third morning as noted the patient is brought to the Nose and Throat Department. Here his mouth, the pharynx and the operative field are cleansed with an alkaline solution and are sprayed with neosilvol. He is then returned to the general care of the internist, but with the following instructions from our Department:

For the first two days you have followed a program of rest, quiet and suppression of reaction in the throat. From now on the after-care is more active, looking toward stimulation of healing and minimizing of the pain and tenderness.

1. Drink freely of water, approximately one glass an hour. The addition of a small amount of baking soda to the water is often quite soothing. The water may be cold, hot or warm as may be most acceptable. Usually a cup of some quite hot drink, at the beginning of each meal, relaxes the throat and helps swallowing.

2. Come in to the Nose and Throat Department daily for one week for treatment. At the close of this time your surgeon will inspect the throat and give advice as to further care.

3. To keep the throat and mouth clean gargle before and after meals and on rising and retiring with a weak salt solution (one-half level teaspoonful of salt to one glass of hot water). The use of any standard mouth wash is permissible.

4. Consult your attending physician in regard to bath prescriptions especially adapted to stimulate the circulation of the neck and throat.

5. Consult the dietitian in regard to your diet. We advise a soft diet.

6. Occasionally a special hot gargle just before meals will further help to relax the throat. For this purpose you may get six ounces of Dobell's solution at the Pharmacy to be used with equal parts of hot water. After the third day the chewing of gum for fifteen or twenty minutes after each meal is often very good to relax the muscles of the throat.

Diabetic patients should get unsweetened paraffin at the Pharmacy instead of the ordinary sweetened gum.

The operative experience falls into three periods, (a) the thinking about it in advance, which to many a nervous patient is by no means a little thing; (b) the operation itself, which if properly conducted is the least part when reviewed in the memory of the patient and (c) afterward, which from the physical side is the most painful and annoying, though from the psychological viewpoint it is much easier than either of the other two.

In our experience the essentials of aftercare are few: general quiet, warmth of the body, inhibition of talking and of clearing the throat, and the free intake of water. Of all these the most important is water, at the rate, when awake, of a glass an hour. We have tried mouth-washes, gargles, troches, tablets, powders, fomentations, ice-bags, massage, and stretching of the pharyngeal funnel by lifting the head when swallowing. Each has its merits and varies in value in different cases. But best of all and the sheet anchor of smooth convalescence is the large water intake as prescribed.

The convalescence likewise falls into three periods, a week to the period. At the end of the first week the patient is physically over being cross or annoyed about the operation. He can eat, drink and be merry as evidenced by laughing. At the end of the second week he has forgotten just what day the operation was done. By now he can yawn, sneeze and even sing if he is so inclined. By the end of the third week he is back to where he was before the operation. The patient or surgeon who expects convalescence of much shorter duration will be disappointed. When one considers that the tonsil operation is at the worst surgical site in the whole body, it is not surprising that it is usually remembered by the graduated patient as a real event. He can join with Irving Cobb in reminiscences. The faucial wounds are all that a surgical field should not be.

The pillars are left separated, making a wound which is wide open instead of closed and held by tension sutures, wet rather than dry, infected rather than clean, hot rather than cool, and in constant motion rather than quiet. On one occasion a patient on the second day was observed to have laid aside her book. When it was mentioned, she said: "Yes, it hurts my throat to read." She further explained that any emotion evoked by the reading caused movements of her throat that were painful. Usually reading and sleeping are the favorite pastimes for the first two or three days.

Not infrequently cases present themselves with tonsil remnants remaining after one or more attempts at removal. These cases are always interesting from a clinical and surgical viewpoint. In fact the absorption or focal infection probabilities from such remnants, more or less covered and bound down by cicatricial tissue, are greater than in the average diseased but untouched tonsil. Furthermore the distortion of the pillars and the uncertainty of the findings under the scars always lend an added interest to the operation. The careful approach and dissection by the technique proposed make the handling of these secondary cases relatively simple. The complete removal is insured and the functional activity of the muscles of the fauces is restored to the greatest possible extent.

In three cases observed the palatal distortion was very marked and the uvula apparently amputated. In each case the dissection revealed the uvula to be drawn to one side and grown fast in the upper part of one fossa. It was liberated, the attached raw surface sutured to prevent cicatricial distortion and adhesion again of the uvula to the raw surface of the fossa. In one case the uvula was sutured to the opposite side of the fauces for a few days to insure its being retained in normal relation. Certainly many of these secondary tonsillectomy cases cannot be handled nearly so satisfactorily under general anesthesia as

under local anesthesia with deliberate dissection.

Twenty years ago a patient past forty years of age was considered to be quite an undesirable surgical risk following tonsillectomy. Experience has shown this not to be true. A person of fifty or sixty has as a rule less local reaction and discomfort and no more general depression than a person in the twenties or thirties.

The question must be considered of whether or when to operate on a patient with diabetes mellitus, increased blood pressure, myocarditis, 'angina pectoris, nephritis, lues, tuberculosis, and organic or functional nervous disease. In diabetes the benefits of the elimination of foci of infection are so evident that diseased tonsils should be removed if possible. The metabolic department carries the patient until his blood sugar and general conditions warrant, and then, with a minimum of delay or opportunity to worry, the patient is operated on. We have had no cause to regret this plan. The same plan is pursued with the cardiac department in relation to cardio-vascular-renal cases. In luetic cases, the genitourinary department indicates when it is proper to proceed. It is not necessary to get a negative serological reaction before operation with complete safety. In neurological cases, whether the benefits that will probably ensue justify and whether the condition of the patient warrants operation must be decided by the attending neurologist. An extremely nervous patient may be controlled by the choice of preliminary hypnotic.

In general, any operation on the nose or throat under local anesthesia is a psychological strain that must be admitted and handled. It is better to surround the patient with quiet, calm, and subdued light during the twenty to thirty minutes after the hypodermic has been given. When the patient is then taken to the operating chair, each move by the nurse or surgeon must be definite and purposeful. The patient may express his emotional agitation in various ways. This psychological swing of his emotional pendulum may be properly allowed to go without repression. After the infiltration has been completed, it is made clear that this is the most annoying part of the whole procedure. The pharyngeal reflex that induces gagging and inhibits breathing is markedly reduced by the anesthetic. During the few minutes between this infiltration and the actual beginning of the operation, the patient practically always relaxes in nerve tension to a surprising degree. If the surgeon at that time can estimate the personal characteristics of his patient so as to say and do the right thing, the emotional swing soon reaches normal. Thus as a rule the few minutes of surgical manipulation are quiet and the procedure closes with the patient in a happy state of mind and without unpleasant memories of the occasion.

A PLEA FOR

EARLY PROSTATECTOMIES

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WHEN a patient with prostatic symptoms presents himself for examination, the urologist is confronted with two equally important problems: (1) the making of a complete and exact diagnosis and (2) the preparation of a definite and appropriate program of treatment.

In the study of a case special care must be taken to determine the exact cause of the symptoms observed. It must not be forgotten that every patient with urinary symptoms should be informed respecting their causes and carefully instructed how these causes may be removed and avoided. To ascertain that the patient is suffering from prostatic trouble without going deeper into the case is wholly inadequate. The particular type of prostatic disease with its predisposing and exciting causes should be determined. Fortunately, urologists now have at their command instruments of precision and standardized methods of examination which makes it entirely possible to do this. A patient who gives a history of frequent urination with gradually increasing nocturia, hesitancy, diminished size of stream, dribbling and dysuria presents a case which requires careful study and complete investigation.

In making a urological examination it is highly essential that a definite and systematic routine should be followed. In general it is not best to complete the examination at a single seance but to proceed with much care and caution. This is particularly true in the case of patients who have never been catheterized before. In very advanced cases it is of the utmost importance. A plan of procedure followed by myself and my associates is the following:

1. After taking a careful history the patient is given two glasses into which he is asked to void urine: into one, the first that he passes, and into the other the last that is voided, particular care being taken to completely empty the bladder. Careful note is made at once of the physical characteristics of the urine and the specimens are then sent to the laboratory for chemical and microscopical examination.

2. The external genitalia are next inspected. Not infrequently a phimosis with stenosis or a visible stricture at the meatus is found to be the sole cause of symptoms. I not infrequently encounter cases of this sort in which a diagnosis of prostatic trouble had been based upon the patient's account of his symptoms without a physical examination and in which the patient had been treated over a long period and of course without receiving benefit.

3. The prostate is carefully palpated through the rectum. Its size, consistency and border outline are carefully noted. By means of a gentle massage of the prostate its secretion is expressed and collected on a slide for microscopic examination. By this means it is possible to differentiate between a chronic follicular prostatitis and simple true hypertrophy of the gland.

4. Next a catheter is passed to determine if residual urine is present, and if so, its amount and characteristics. This part of the examination is highly important for it is the only means except cystoscopy by which a definite idea can be formed of the extent of the impairment present. The prostate by palpation may appear to be normal in size and consistency notwithstanding the fact that 1 to 4 ounces of residual urine is always left in the bladder after evacuation. Enlargement of the

641

prostate when present may be intravesicular in type or there may be a simple bar obstruction. It is to be remembered that incompetency of the bladder to evacuate its contents may be due to other causes than prostatic enlargement, pathological conditions which are unrecognizable by rectal palpation.

After catheterization an ounce of a 5 per cent solution of argyrol is left in the bladder and the patient is instructed to

FIG 1 Small retention type of diverticula which greatly aggravated the bladder symptoms These gradually enlarge as obstruction advances

note the number of urinations in which the dark color produced by the argyrol appears. The argyrol not only prevents infection from the catheterization, which may sometimes occur notwithstanding the use of every known precaution, but is a clear demonstration to the patient of the degree of obstruction from which he is suffering and thus renders him intelligent in relation to the problems with which his physician has to deal.

The patient is given hexamethylenamine and asked to return the next day. If at the next visit the patient reports that the

argyrol was seen in four or five urinations or was still present at the end of twenty-four hours, this fact is visible evidence of a definite pathological condition and of the necessity for cystoscopic examination for the purpose of determining the exact pathological condition present. By means of cystoscopy and urography combined, the cause for the urinary residuum may be definitely determined. The findings from such an examination may be a diverticulum

FIG 2. A case of unilateral renal reflux resulting from an incompetent ureterovesical valve which was produced by the infection and aggravated by the increased back pressure.

(Fig. 1), incompetency of the ureteral vesicular orifice (Fig. 2), stricture of the ureter, urethral stricture, a neoplasm, foreign body, a paresis of the bladder secondary to a lesion of the cord or prostatic obstruction. In certain cases a cystogram is necessary for an exact determination of the pathological conditions present.

In case the obstruction is found to be due to a neoplasm, it is of the utmost

importance to determine at as early a moment as possible whether the growth is a simple adenoma or a carcinoma. An early diagnosis in these cases is by no means an easy problem. Special stress is laid upon the intensity of symptoms. In general small quantities of residuum are accompanied by more intense symptoms in cases of malignancy than when the case is one of simple adenoma. Search must be made for small indurated isolated areas in

Fig. 3. Advanced bone metastasis in a case where the outstanding symptoms were backache and sciatica. Urinary symptoms were minor and were completely ignored by both the patient and his physician.

the gland which cannot be made to disappear by gentle massage. It should also be noted that in cases of malignancy massage is not followed by a considerable amount of expressed secretion and also that the gland is unusually hard and less movable than it should be and that its marginal outline is not well defined. In some cases the diagnosis of malignancy may be based upon the demonstration of metastases in the pelvic bones by roentgen-ray examination (Fig. 3). Metastases in

the pelvic bones are sometimes discovered in cases in which no urological symptoms have developed, the symptoms chiefly being pain in the back or in the sciatic nerve.

It is also important to remember that bladder symptoms may be present without prostatic pathology. Urinary frequency and nocturia may be the result of arterial hypertension, an endocrine unbalance or a disturbed carbohydrate metabolism.

If the results of the examination show

Fig. 4. An advanced case of trabeculation with diverticula which developed in a case in which operation was delayed two years after conditions indicated the need of prostatectomy.

the cause of disturbance to be a benign adenoma or a simple prostatic hypertrophy, what should be our advice to the patient? In my judgment the advice in such a case should be early removal. The let-alone policy still too often followed is an antiquated and obsolete method of dealing with these cases. When we possessed no accurate means of differentiating a simple hypertrophy from other causes of bladder disturbances and when the operation of prostatectomy was accompanied by a high mortality rate and frequently followed by undesirable sequelae, we were justified in assuming a watchful waiting attitude in these cases, but the perfected urological methods of the present day not only give us the means of a high degree of exactitude in diagnosis but enable us to deal with these conditions with a degree of safety closely approximating 100 per cent. Too many patients are still being

advised that prostatic trouble is a natural and necessary accompaniment of advanced age, something which must be accepted and patiently endured. Such teaching is not supported by authoritative urological data and is most harmful. Of course a certain amount of temporizing with palliative local treatment is justifiable and proper, especially while the case is being studied and as one means of becoming thoroughly acquainted with the pathological conditions present, but as soon as it has become clearly apparent that the conditions present cannot be definitely and substantially bettered by non-surgical treatment, radical measures must be recommended and applied. Much harm is done by advising patients to continue palliative treatment indefinitely or until conditions become unbearable before the adoption of radical measures. When such advice is given and followed, what is the result? The pathological conditions present have progressed from a simple uncomplicated state to a highly advanced and greatly aggravated diseased condition. The patient through loss of sleep and consequent lowered vitality has become weak, anemic, depressed and in every way poorly prepared to go through the ordeal of an operation, thus greatly increasing the risk attending the application of the only means which can afford radical relief.

Neglect or delay always leads to the development of complications of various sorts. Stasis is always an open invitation to infection. This is as true in relation to the urine as with the intestinal residues. A moving stream purifies itself while a stagnant pool quickly becomes foul. Residual urine leads to the formation of calculi. The back pressure upon the kidney which often occurs lessens renal efficiency and leads to the accumulation in the blood of nitrogenous waste products, as shown by an increase of non-protein nitrogen. General health impairment results. Digestion is disturbed, often to such a degree that the patient is led to regard it as the chief cause of his ill health. Any tendency to arterial hypertension is increased and changes in the arteries are accelerated. Vicious circles are formed and the patient is hastened on to complete physical bankruptcy. In advanced cases of urinary obstruction trabeculations develop, small, inert diverticuli are enlarged, the bladder pathology is increased and conditions develop which are irreparable, so that the complete relief which might have been obtained by an early operation becomes no longer possible no matter how skillfully the operation may be performed.

Another and still more serious result of delayed action in cases of prostatic enlargement is the development of malignant disease. Cancer of the prostate is usually primary. A reason for this is readily found in the fact that in adenoma of the prostate there are found certain histological elements which under prolonged irritation readily develop into cancer.

The large number of cases of advanced prostatic cancer which appear in every urological clinic are a striking evidence of the terrible price which is paid for the short respite obtainable through delay of surgical treatment. In many of these cases the patient has been treated by dilatation of the urethra, douching of the bladder, massage of the prostate and various other manipulations until the cancerous growth has extended throughout the prostate and has even broken through its highly resistant capsule and invaded the surrounding tissues, even involving through metastasis the pelvic bones. In such cases there is nothing left to be done but to wait for the undertaker. The fact that cancer is found to exist in from one-tenth to one-fourth of all the prostates removed by operation is of itself a sufficient reason for the early performance of prostatectomy in these cases. In view of these facts we are more than justified in the view that on an average at least one out of every five of all cases of prostatic enlargement that come under observation is malignant. The early removal of all prostatic adenoma would certainly save many men from terri-

ble suffering and an untimely and in many cases, to say the least, unnecessary death.

A frequent cause of deferred action in these cases is the apprehension that prostatectomy will be followed by sterility or impotency. Not infrequently patients say, "My doctor advised me against operation, saying, 'Delay it as long as you can for you will be no good afterward.'" Such advice is not soundly based. I know from numerous personal observations that a person who is potent before the operation of prostatectomy will be potent after the operation, and not infrequently patients report an increase of sexual vigor as one of the good results of the operation. Certainly the number of persons who find their sexual vigor increased by the operation greatly exceeds those who experience the opposite effect.

The writing of this article was prompted by a recent consultation with a patient whom I first saw more than a dozen years ago. In 1915, finding him to be suffering from an enlarged prostate, I strongly urged him to submit to a prostatectomy. He declined the operation, however, and for five years sought relief at the hands of many specialists who subjected him to various different procedures and modes of treatment. As I expected, he steadily grew worse in spite of all treatment until his suffering became unendurable and in 1920 prostatectomy was performed. In the meantime such serious complications had developed that a two stage operation was necessary. He was obliged to remain in the hospital several weeks instead of getting out in a few days and his recovery was by no means so complete as it might have been since a considerable degree of irreparable damage had been done as a result of the long delay. Today he says, "What a fool I was to endure all that suffering for five years. How much better off I would be today if I had had the operation done at once when the condition was discovered instead of waiting until I was compelled to submit to it."

Experience with a large number of similar cases has fully convinced me that once a diagnosis of prostatic enlargement is definitely made and when the enlargement is so great as to be clearly responsible for symptoms and the cause of the retention of at least two ounces of residual urine, the patient should be advised to submit to an operation as soon as it can be conveniently arranged. The patient is thus enabled to prepare for his operation without undue haste in the arrangement of his affairs, the surgical hazard is practically nil, his hospitalization is on an average not more than two or three weeks and he can be assured not only of a good recovery from his operation but of the complete disappearance of the distressing and annoying symptoms from which he has suffered and of the added suffering, worry and general health impairment certain to develop when action is delayed. The early removal of the enlarged prostate is in my opinion not only a feasible but a most desirable procedure.

THE REACTIONS OF THE BODY TO
THE SHORT COLD BATH

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BATTLE CREEK, MICHIGAN

HYDROTHERAPY is not only the oldest of the physical therapies but without doubt is the most ancient of all remedies used in the treatment of disease. In these days when so much attention is directed to electrotherapy, phototherapy, etc., it may appear somewhat old-fashioned to discuss one of the agents of this ancient system of therapeutics. But without in any way discounting the value of other physical remedies, I believe that hydrotherapy, particularly in the form of short cold baths, will bring about more useful and desirable changes in the functions of the body than any other form of therapeutics.

Formerly used in an empirical way, hydrotherapy in more recent times has been put on a thorough scientific basis as the result of much scientific experimentation and observation. However, the manner of action and the effects of different forms of baths are undoubtedly not generally understood or appreciated.

The writer has made use of hydrotherapy in the treatment of many chronic and acute diseases for more than forty years. At different times experimentations have been conducted on normal individuals for the purpose of studying the physiologic effects of different forms of baths. The reactions of the body to the short cold bath have been particularly studied in these series of experiments, and more recently a careful study in the changes of metabolism, produced by the short cold bath, has been made. The purpose of the present paper is to express in a brief and concise way the results of these experiments.

Cold baths usually mean the application of water to the body at temperatures varying from 80° to 32°F. In the present paper the writer is reporting the effects of the bath at temperatures varying from 90° to 55°F. A short cold bath, as the term is used in this paper, means the application of cool or cold water to the body of from one-half to three minutes' duration, in most instances about one minute.

The cool or cold bath may be applied to the body in different ways and the dosage of cold may be varied, depending upon the manner in which it is applied, the temperature of the water, and the length of time of application.

The most common forms of cold baths are the wet hand rub, the mitten friction, the wet towel rub, the wet sheet rub, the needle bath, the shower bath, the spray douche, the percussion douche, the full tub bath, the plunge, and the swimming bath. In all of these different forms the application of cold water is made to all or some particular part of the surface of the body for only a brief time, from one-half to three minutes. When water is applied to only a part of the body at a time, the length of time necessary to complete the bath would be perhaps ten or fifteen minutes, but the application of cold water to any particular area of the body would be only for a very short time, not more than one-half minute, so that all of these different forms of baths may be classed as short cold baths.

The effects of all these different forms of applying cold water to the body are essentially the same. The difference in the reactions for the different baths is one of degree or quantity rather than one of kind or quality. The different forms of cold baths mentioned above offer a means by which the dosage can be varied from a small

dose, as for instance in the cold wet hand rub, to a large dose, as in the spray douche or plunge bath. In the present paper the effects of the short cold spray bath and the short cold full bath have been particularly studied, and the results obtained from the study of these may be taken to indicate the effect of other short cold applications to the entire surface of the body.

The effects of the short cold bath upon the body are the result of the thermic and mechanical factors that are simultaneously active in the application of the bath. The more important of these is the temperature of the water. A cold bath is taken for the purpose of applying cold to the body. It is the cold in the water that does most of the good. The water is simply a carrier or vehicle of the cold, a convenient way of applying cold to the body.

The application of cold to the body in the form of baths produces two effects, the primary action of the cold and the secondary or reaction to the cold. The primary action is always a depressive action. It depresses the activity of the tissues and the organs of the body to which it is applied. The secondary effect or reaction has an exciting effect. It stimulates the functions of the tissues and organs of the body. The primary effect is usually local; the secondary effect may be local or general or both. It is the secondary or reaction effects that are the most important and upon which the good effects obtained are largely dependent. This secondary or reaction effect of the cold is the result of reflexes that are set up in the internal organs of the body as the result of application of cold to the surface.

In certain forms of baths, such as a cool spray at 90°F., the primary and secondary effects may be equal; in other forms, such as a prolonged cool bath, the primary or action effect of the cold may be in the ascendancy. On the other hand, when a spray or needle bath is applied to the body at a temperature of 60° or 70°F. for a short time, the reaction or reflex effect is greater than the primary or action effect.

The good results of the short cold bath are largely the result of reaction to or reflex effects of the cold.

These reflex effects are brought about through the medium of the nervous system. The nerves that carry sensations of heat and cold from the skin towards the central nervous system have their endings in the skin. The surface on the skin immediately overlying the endings of these nerves are known as the hot spots and cold spots. The number of these cold spots on the skin surface varies in different parts of the body, as is illustrated in Figure 1. When the cold water is applied to the surface of the body these cold nerves are stimulated and carry inward nervous impulses which, acting upon the nerve centers in the spinal cord and in the brain stem, set up a series of reflex activities which modify the action of the organs within the body.

It is a well established physiologic fact that the action of the organs within the body may be changed by making impressions on the outside of the body. In fact, nearly all physical therapy is dependent upon this fundamental physiologic principle. The good results obtained by the application of the short cold bath to the body is largely the result of strong and numerous reflexes in the different organs of the body as the result of strong impressions that are made by the application of cold water to the surface.

Figure 2 is a schematic illustration of the nerve pathways from the skin through the nerve trunk, nerve roots and spinal cord, and also shows the efferent pathways from the spinal cord out to the viscera and internal organs. When impressions of cold are made upon the skin there are numerous nervous impulses set up which travel in the afferent pathways to the spinal cord and to the nerve centers in the brain stem. These in-going impulses set up by the application of cold on the skin stimulate the nerve centers in the spinal cord and in the brain stem, and as a result efferent impulses are sent out to the internal organs. In
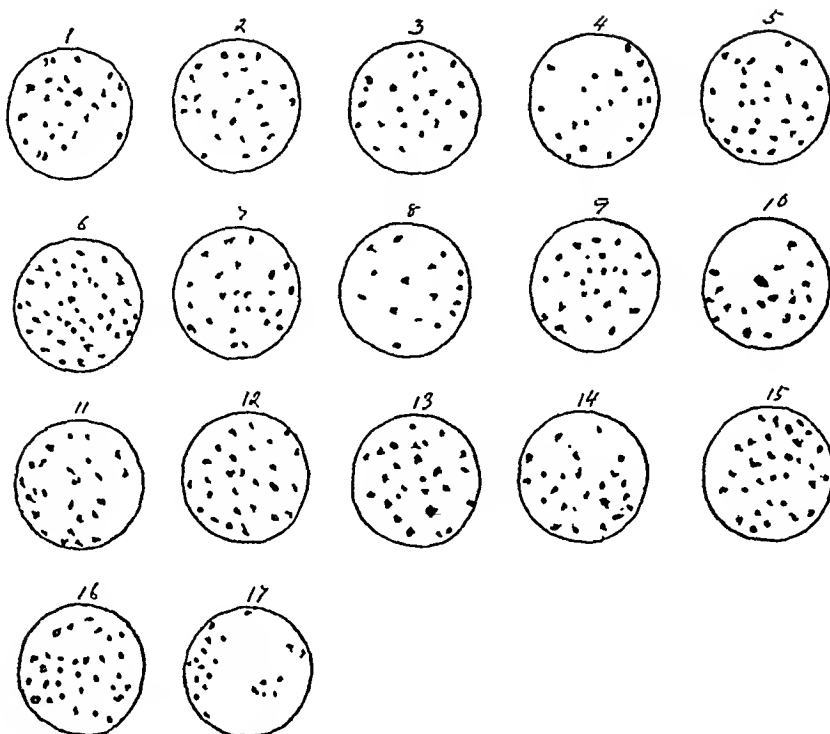
FIG. 1. Illustration showing the number of cold spots in different parts of the body. The number of cold spots in the circle 2 cm. in diameter, in each of seventeen different parts of the body. 1. Forearm, outside; 2. Forearm, inside; 3. Upper arm, outside; 4. Upper arm, inside; 5. Cheek; 6. Forehead; 7. Chest; 8. Abdomen; 9. Thigh, inside; 10. Thigh, outside; 11. Leg, inside; 12. Leg, outside; 13. Upper part of foot; 14. Neck, in front; 15. Upper spine; 16. Lower spine; 17. Back of hand.
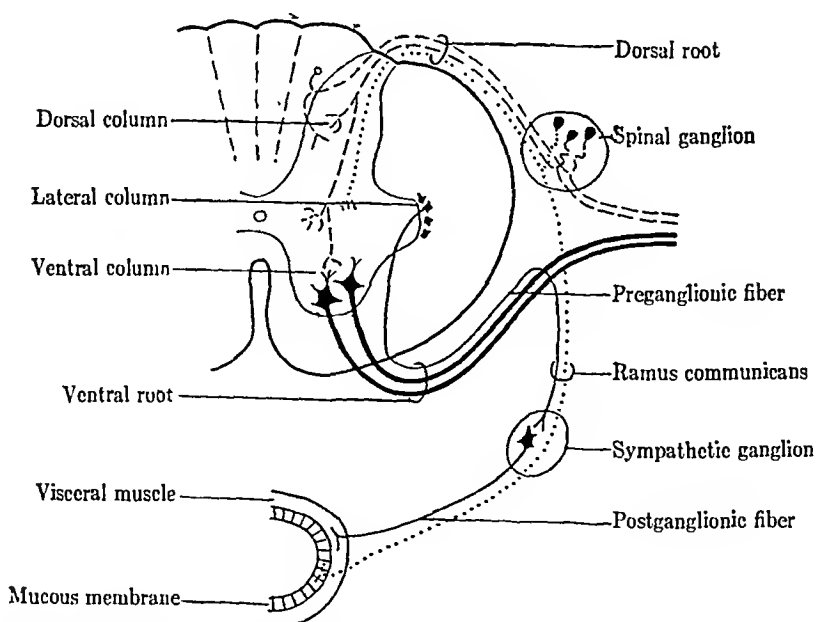
FIG. 2. Illustration (from Ranson) showing reflex pathways to spinal cord. Diagram illustrates the composition of a typical spinal nerve in the thoracic region. The somatic sensory system is indicated by broken lines, the visceral sensory by dotted lines, the somatic efferent by heavy continuous lines, the visceral efferent by lighter continuous lines.

this manner the action of the internal organs is stimulated and changed.

The good effects of the applications of short cold baths to the body are dependent upon the following factors:

1. The ability of the individual to react to the cold. The greater the reaction to the cold the greater the effect. A cold bath at a temperature which may act as an excitant and stimulant to one individual may act as a depressant to another. In the first case the individual reacts to the cold; in the second, he is not able to respond or react, consequently the effect is depressing.

2. The amount of surface to which the water is applied. The greater the area of surface to which the water is applied, other things being equal, the greater is the effect.

3. The temperature of the water. The colder the water the greater is the effect, providing always that the individual reacts to the cold. The effect is greater at lower temperatures because the intensity of the impressions is greater for lower temperatures than for those that are less cold.

4. The mass or quantity of water that is applied to the body at a single moment. The greater the mass or quantity the greater the effect. For instance, a needle spray with few jets of water impinging against the body would have less effect than a similar spray with twice or three times the number of jets impinging against the body. The same principle applies to other forms of baths.

5. The length of time that the water is applied to the body. The longer the time the greater the effect, providing always that the individual reacts. It should be stated, however, in this connection that we are dealing with the short cold bath, the time usually one minute, seldom beyond three minutes.

6. The particular part of the body to which the water is applied. The rule is that the skin over any organ represents the organ beneath; that is, cold applied immediately over an organ will develop greater reflex effects in the organ than cold applied to a similar area of skin in some other part of the body. To illustrate, the effects of local application of cold applied immediately over the heart would bring about greater reflex effects in the heart than the same amount of cold applied to an area of the same size in some other part of the body which is less closely associated reflexly with the heart.

7. The mechanical effects that are produced by the various methods above mentioned, such as friction with the cold mitt or wet towel rub, or the mechanical impact of water on the surface of the body as with the needle spray or douche, etc. These mechanical effects are for the most part the same as those produced by the cold; that is, they set up reflexes which augment and intensify the effect of the cold and their effects are blended with those of the cold.

We may now notice the effect of the short cold bath upon the different organs and systems of organs of the body.

THE SKIN

The effect of the cool or cold bath on the skin may be briefly stated. It produces a contraction of the non-striated muscular tissue within the corium which surrounds the hair follicles, the arrectores pilorum, and produces the elevation about the hair follicles, a condition commonly known as goose-flesh (cutis anserina). This effect is more pronounced if the cold spray be preceded by a warm bath or a warm spray of a few minutes. The cool bath causes a contraction of the blood vessels of the skin and at first produces pallor. This, however, is quickly followed by dilatation of the cutaneous vessels and a ruddy glow results, which is what is meant by the cutaneous reaction to the cold bath. If the bath be continued, the superficial vessels contract again and the skin remains pale for a time.

The short cold bath temporarily lessens the secretion of sweat and diminishes the activity of the sweat glands but this is
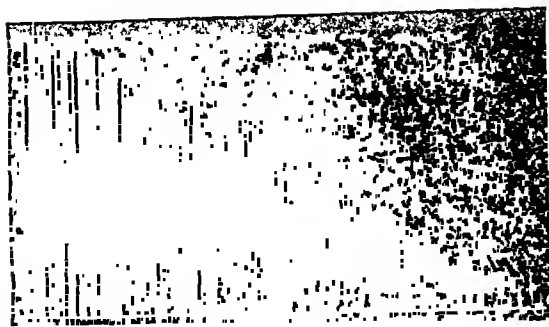
FIG. 3. Illustration (after Kellogg) showing normal fatigue curve; total work 6.703 kgm.

and the nutrition of the skin are very much below the normal. The use of the short cold bath is one of the best means of improving this weakened and diseased condition of the skin. It improves the circulation of blood and stimulates the nutrition in a way that nothing else can do. Its usefulness is often augmented by preceding the cold bath with sunlight baths or some form of phototherapy.

THE MUSCLES

The effect of the short cold bath on the muscles is to increase muscle tone and elasticity, to increase the capacity for

soon followed by a reaction, and when the reaction is strong, as in a young person reacting to a short cold bath of low tem-
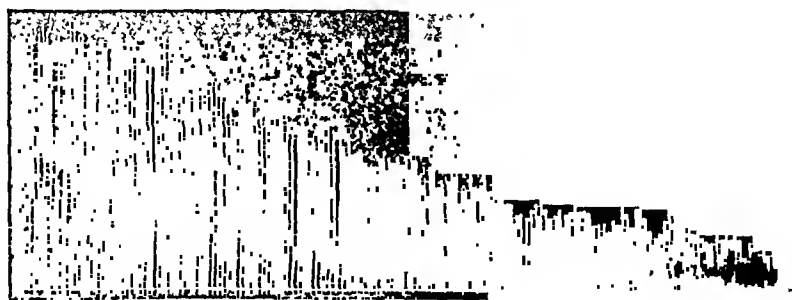
FIG. 4. Illustration (after Kellogg) showing fatigue curve of the same subject after a cold douche; total work, 9.805 kgm.

perature, the reaction may be so great as to produce increased perspiration.

In many chronic diseases the skin is pale, anemic and inelastic, and more or

work, to increase endurance and lessen fatigue. The increase of muscle tone may be easily observed by feeling the muscles of the arm before and after the bath.
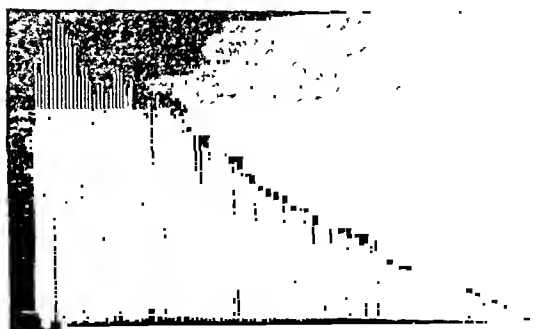
FIG. 5. Illustration (after Kellogg) showing normal fatigue curve of man aged twenty-four years; total work, 8.088 kgm.

FIG. 6. Illustration (after Kellogg) showing fatigue curve of same subject after a hot bath; total work, 5.152 kgm.

less wasted and thinned out and some-times covered with flattened moles and warts, and the circulation of the blood

The greater firmness of the muscle to touch and increased elasticity show that the muscle tone is increased. The increased capacity for muscular work and endurance may be easily demonstrated by the use of
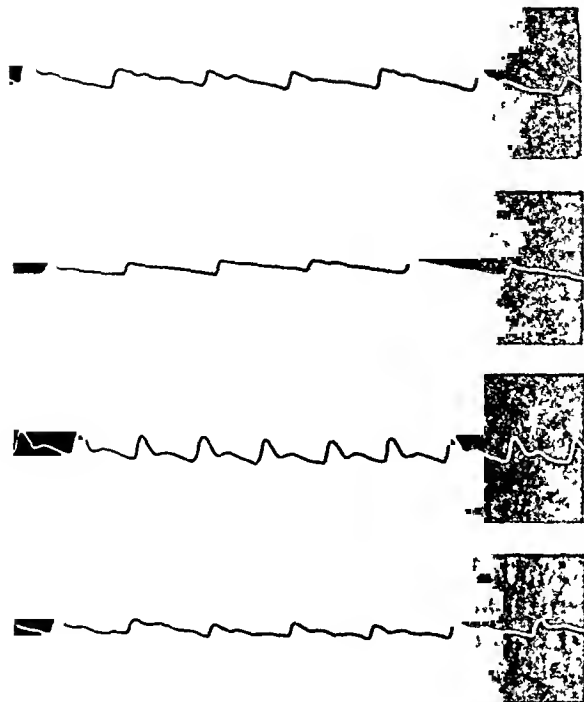
Fig. 7. Sphygmographic tracing of the pulse of Case 1 just before taking a spray at a temperature of 90°F.

Fig. 8. Sphygmographic tracing of the same immediately following a spray at a temperature of 90°F. for two minutes.

Fig. 9. Sphygmographic tracing of Case 11 before taking a spray at a temperature of 80°F.

Fig. 10. Tracing of same after taking a spray at 80°F. for two minutes.

Fig. 11. Sphygmographic tracing of Case 111 before taking spray at a temperature of 70°F.

Fig. 12. Tracing of same after taking spray at a temperature of 70°F. for one minute.

Fig. 13. Sphygmographic tracing of Case 1v before taking spray at a temperature of 60°F.

Fig. 14. Tracing of same after taking spray at a temperature of 60°F. for one minute.

Mosso's ergograph which measures the capacity for muscular work and shows the fatigue curve. With the ergograph a tracing may be made of the extent and duration of the movements of the forefinger. These movements are recorded on a revolving cylinder of the ergograph. Each white line made on the smoked paper represents a movement of the finger and the height of the line represents the amplitude of each movement, and the number of lines indicates the number of movements that are made by the finger. In this way the capacity for muscular work and the normal fatigue curve may be established. Figure 3 shows a tracing of this kind before the individual took a cool spray douche. Figure 4 is a tracing after taking a cold douche, and illustrates the increased endurance and increased capacity for muscular work and a lessening of muscular fatigue, all of which were the result of the cold spray douche. Figure 5 illustrates the fatigue curve of an individual before taking a warm bath, and Figure 6 the fatigue curve after a warm bath. It will readily be seen by comparing the tracings in Figure 4 following a short cold bath with the tracing in Figure 6 following a warm bath that the short cold bath increases the capacity for muscular work and lessens muscular fatigue, whereas the warm bath has the opposite effect.

THE CARDIOVASCULAR SYSTEM

The short cold bath increases the force and lessens the rate of the heart beat and increases the tone of the heart muscle; it increases the tone and lessens the lumen of the arteries, it diminishes the diastolic pressure and increases the systolic and pulse pressure and thus accelerates the circulation of the blood. The above mentioned changes in the cardiovascular sys-
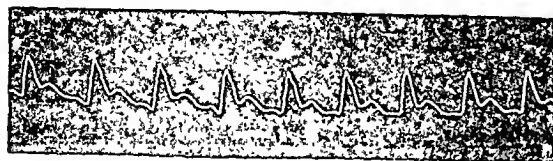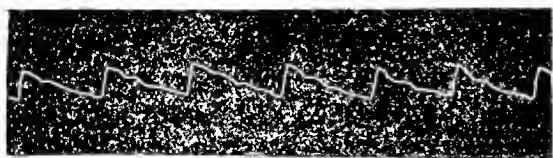
FIG. 15. Sphygmographic tracing of Case v before taking a spray at a temperature of 55°F.
FIG. 16. Tracing of same after taking spray at a temperature of 55°F. for one minute.
FIG. 17. Sphygmographic tracing of the pulse of a young man before placing arm in water of a temperature of 60°F.
FIG. 18. Tracing of the same after the arm had been in water at a temperature of 60°F. for ten minutes.

FIG. 19. Sphygmographic tracing of Case vi before taking a full bath at a temperature of 60°F.
FIG. 20. Tracing of the same immediately after taking full bath at a temperature of 60°F. for one minute.

tem as the result of the application of the short cold bath to the body are illustrated in the following report of the effects of the short cold bath on healthy young men from the ages of twenty to twenty-five years, and also in the report below on the changes in blood pressure (Figs. 7 to 20).

CASE I. Before spray at 90°F. for two minutes, pulse is 62 per minute; respiration, 17 per minute; temperature in mouth 98.1°F. Pulse tracing is shown in Figure 7.

After taking spray at 90°F. for two minutes, pulse is 56; respiration, 14; temperature, 98.3°. Pulse tracing is shown in Figure 8.

CASE II. Before spray, pulse is 82; respiration, 18; temperature 98.6°. Pulse tracing shown in Figure 9.

Immediately after taking cool spray of 80°F. for two minutes, pulse is 64; respiration, 14, temperature, 98.6°. Pulse tracing shown in Figure 10.

CASE III. Before spray, pulse is 76; respiration, 19; temperature, 98.2°. Pulse tracing shown in Figure 11.

After spray at 70° for one minute, pulse is 57; respiration, 16; temperature, 96.6°. Pulse tracing shown in Figure 12.

CASE IV. Before spray, pulse is 60; respiration, 17; temperature, 98.6°. Pulse traeing shown in Figure 13.

After spray at 60° for one minute, pulse is 50; respiration, 11, temperature, 98.6°. Pulse tracing shown in Figure 14.

CASE V. Before spray, pulse is 60; respiration, 17, temperature, 98.3°. Pulse tracing shown in Figure 15.

After spray at 55° for one minute, pulse is 47; respiration, 19, temperature, 98.2°. Pulse tracing shown in Figure 16.

CASE VI. Before bath, pulse is 68; respiration, 14; temperature, 98.8°. Pulse tracing shown in Figure 19.

After full bath at 60° for one minute, pulse is 58; respiration, 13; temperature, 98.8°. Pulse tracing shown in Figure 20.

It will be seen from the foregoing that the short cold bath reduces the frequency of the pulse. The amount of reduction, other things being equal, depends upon the temperature of the bath, the cooler the bath within certain limits the greater the reduction of the rate of the pulse. The reduction in the rate of the pulse also varies with the extent of the surface of the body exposed to the bath. When the spray bath is directed to the whole surface the pulse rate is reduced much more than when only a part of the body is exposed. Placing

the hand in water at a temperature of 60° for ten minutes will reduce the pulse several beats per minute. The amount of reduction in the pulse rate also varies with individuals. In a weak individual a spray of 90°F. for one minute may lessen the pulse rate as much as a spray of 70° or even 60°F. in an individual of more rugged habits.

By referring to the sphygmographic tracings shown in Figures 7 to 25 inclusive, it will be seen that the short cold bath causes very decided changes in the sphygmographic tracing of the pulse. We may note these changes briefly. A sphygmographic tracing of the pulse may be described as a series of curves, each of which corresponds to one beat of the heart. Each pulse curve consists of the line of ascent, the apex and the line of descent.

The line of ascent or up-stroke is nearly vertical. It occurs during the dilatation of the artery and is produced by the systole of the left ventricle of the heart. The apex is the highest point in the up-stroke. The line of descent is gradual and corresponds to the diminution in diameter of the arteries. It is usually interrupted at one or more points by distinct elevations or secondary waves, the most important of which is the dicrotic wave. The height of the up-stroke depends upon at least two factors, the force of the systole of the left ventricle and the condition of the blood vessels. The stronger the systole of the left ventricle, other things being the same, the greater the length of the up-stroke, and the lower the blood pressure in the arteries the greater the up-stroke or percussion wave. A relaxed and dilated condition of the blood vessels favors an increase in the length of the up-stroke of the pulse. The dicrotic wave is more marked the lower the tension of the blood within the vessels. A relaxed condition of the blood vessels, therefore, favors the development of the dicrotic wave.

By referring to the tracings taken before and after the cool spray, it will be seen that besides lessening the rate of the pulse,

it diminishes the length of the up-stroke and partially or entirely obliterates the dicrotic wave and increases the length of the line of descent. This does not mean, as might be thought at first from the appearance of the change in the tracings, that the heart has been made weaker, for it can be clearly demonstrated with the stethoscope and by studies of the blood pressure that the force of contraction of the heart is not diminished but that it is positively increased by the short cold bath. The change produced in the pulse tracing means that the muscular coats of the blood vessels have been made to contract and consequently the lumen of the vessels has been narrowed and blood pressure within the arteries increased. With an increase in the force of the systole of the heart together with an active narrowing of the arteries, the blood is driven more rapidly through the blood vessels and the circulation is accelerated. If one listens to the heart tones with a stethoscope he will be able to observe clearly that the intensity of the heart tones is increased following the short cold bath and the rate of the heart beat lessened.

By referring to Figures 30 to 39 inclusive, which are made especially to report the changes in the metabolic rate as the result of the short cold bath but which also illustrate the changes in blood pressure, it will be seen that very decided changes in blood pressure follow its application. These records show that the diastolic pressure is reduced and the systolic and pulse pressure increased immediately following the application of the bath. The reduction in diastolic pressure is undoubtedly due to the fact that the capillaries and arterioles are dilated as an expression of one of the circulatory reactions. This dilatation of the peripheral blood vessels, particularly in the skin, lessens the resistance to the passage of the blood stream in the arteries and capillaries, and this accounts for the lowering of the diastolic pressure. On the other hand, the systolic and pulse pressure are increased as the result of increased force of the heart beat and increased muscle
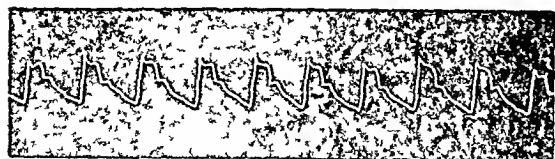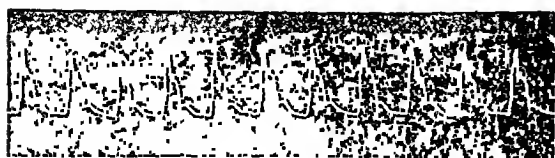
FIG. 21 Sphygmographic tracing of the pulse of a man fifty-eight years old, with hemiplegia caused by hemorrhage.

FIG. 22. The same as Figure 21 after taking a spray bath at 80°F. for two minutes

FIG. 23. Sphygmographic tracing of the pulse before taking a spray at 60°F.

FIG. 24. Sphygmographic tracing of the pulse taken after a spray at 60°F. for one minute.

FIG. 25. Sphygmographic tracing of the pulse taken after a spray at 110°F. for five minutes, which followed the tracing shown in Figure 24, and illustrates the effect of the warm spray bath on the pulse.

FIG. 26. Tracing of the normal respiratory movements of a young man before taking a shower bath at a temperature of 60°F.

FIG. 27. Tracing of the respiratory movements of the same while in a shower bath at a temperature of 60°F.

FIG. 28. Tracing of the normal respiratory movements of another young man before a shower bath at a temperature of 70°F.

FIG. 29. Tracing of the same in shower bath at a temperature of 70°F.

tone in the medium sized and larger arteries. The increased systolic pressure and increased pulse pressure are evidence that the force of each heart beat has been strengthened. This lessening of the diastolic pressure and increasing systolic and pulse pressure improves the circulation.

The above mentioned changes in the sphygmographic tracing of the pulse are also sometimes very forcibly illustrated in certain diseased conditions. There is a condition of the blood vessels which is sometimes present in individuals suffering from hemiplegia and in persons who may be threatened with apoplexy, to which I wish to refer briefly in this connection. In these individuals the walls of the larger blood vessels are relaxed and not at all or at least very slightly sclerosed, but the course of the vessels somewhat tortuous. The pulse is full, bounding and compressible. A pulse of this character is sometimes observed in persons between the ages of forty-five and sixty years, that is, during the so-called apoplectic period of life. It is perhaps more often present in cases of hemiplegia and in such instances is the underlying pathologic condition which is responsible for the stroke. In the blood vessels of individuals of this class the peripheral resistance in the capillaries and smaller arteries is increased by a thickening of the wall and a narrowing of the lumen of

the smaller peripheral blood vessels. With this narrowing of the lumen of the blood vessels the resistance to the passage of the blood stream is increased and an extra amount of work is required on the part of the heart to drive the blood onward. With this increased resistance at one end of the arterial system and an increased action of the heart at the other, conditions are present which dilate the larger blood vessels. The muscular coats of the walls of the blood vessels become relaxed and weakened and sooner or later give way from the pressure within, and the result is that the individual has an attack of apoplexy. Figure 21 illustrates the pulse tracing of a case of this kind before taking the spray bath at 80° for two minutes, and Figure 22 is a sphygmographic tracing of the pulse after taking a spray bath at 80°F. for two minutes. It will be noted that these changes in the sphygmographic tracings are the same as already referred to above; that is, the length of the ascent is lessened, the descent line is lengthened, and the dicrotic wave lessened, all of which means that the larger arteries have been made to contract and the force of the heart has been increased by the short cold bath.

These same changes in the circulation and in the sphygmographic tracings may also be produced by the local application of the cold bath. For instance, if one arm is placed in water at a temperature of 60°F. and kept there for ten minutes and a sphygmographic tracing made from the radial artery of each arm, it will be seen that not only have the blood vessels of the arm which has been placed in water become contracted and blood pressure increased, but a similar change, although to a less degree, has taken place in the arm which has not been placed in water at all. Figure 17 illustrates a tracing in such a case before placing the arm in cold water and Figure 18 represents a tracing after the arm has been in cold water at a temperature of 60° for ten minutes.

Figure 23 represents a tracing of the pulse before taking a spray at 60°F.,

Figure 24, a similar tracing of the pulse after a spray at 60° for one minute, Figure 25, a sphygmographic tracing of the pulse taken after a spray at 110° for five minutes. This tracing followed the tracing shown in Figure 24 and illustrates the effect of the warm spray bath on the pulse tracing. A comparison of these figures, namely, the tracing after a spray bath at 60° for one minute which is followed by a tracing after a spray bath at 110° for five minutes, illustrates the changes that can be brought about in the tone and caliber of the arteries by the use of the cold and warm spray bath, the cold bath causing contraction and lessening of the lumen of the arteries while the warm bath relaxes the arteries and increases the lumen. By means of this hot and cold spray bath the muscular coats of the arteries can be put through a course in vascular gymnastics. This means an improvement in the circulation of the blood in the walls of the arteries which are supplied by the vasa vasorum. This gives us a valuable suggestion of one means at least of preventing or delaying arteriosclerosis. When the blood vessels are exercised in this way by means of the warm and cold bath, the circulation of the blood and the normal nutrition of the arterial wall are maintained and sclerosis of the arteries prevented.

RESPIRATION

The effect of the short cold bath on the respiratory movements is apparent. When quite cold water is first applied to the body the respiratory movements are rapid, spasmodic, irregular and shallow, and considerable difficulty is experienced in breathing. In a short time, thirty seconds or so for most temperatures, the respiratory movements become more regular and deeper, the lungs are more completely filled with air and the respiratory movements continue rapid throughout the bath. The respiration may be as great as thirty or forty or even more per minute in a shower bath at a temperature of 70° to 60°F. At the end of the bath for a short

time the respirations are slower and not infrequently shallower than before the bath but this condition lasts for only a few minutes. The real lasting and beneficial effect of the short cold bath is an increase in the depth of respiration and lung capacity, and consequently an increase in the capacity for the absorption of oxygen. The girth of the chest may be increased two or three inches by the continued use of the short cold shower bath for a period of two or three months, as has been frequently demonstrated.

This change in the respiratory movements is also brought about largely by the reflex action through the medium of the nervous system. The stimulation of the nerve endings in the skin by the cold bath sets up innumerable afferent nerve currents from a large part of the surface of the body which powerfully impress the respiratory centers in the medulla and upper part of the spinal cord. These respiratory centers are most effectively stimulated with cold applications to the trunk of the body and particularly the lower part of the chest, but they may also be stimulated by the application of cold to the extremities. It requires, however, a much lower temperature to affect the respiration by cold application to the extremities, and the respiratory center is more easily affected by applications to the proximal end of the extremities than to the distal end.

Figure 26 represents a tracing of the normal respiratory movements in a healthy young man taken just before the cold shower bath at 60°F. Figure 27 represents the same tracing of the respiratory movements while in the shower bath at 60°. Figure 28 represents the tracing of the normal respiratory movements just before taking a shower bath at 70°. Figure 29 represents the tracing of the respiratory movements of the same while in the shower bath at a temperature of 70°. It will readily be seen from these tracings that the cool shower bath increases the rate and depth of respiration. This means that more oxygen is present in the lungs and the supply of oxygen to the blood is increased.

CHANGES IN METABOLISM

Among the most interesting and important changes brought about in the functions of the body by the application of the short cold bath are those of metabolism. For the purpose of making a study of the changes in metabolism during and following a short cold bath, numerous experiments were made on healthy young men under the general direction of the writer by his colleague, Dr. Paul Roth. A normal basal metabolic rate for each individual was obtained first before the bath was given, then the cold bath was applied to the body and the metabolic rate taken immediately following the bath. In addition to observing the changes in metabolism, changes in the pulse rate and the systolic, diastolic and blood pressures were also observed, both before and after the bath. The result of these studies on metabolism is graphically illustrated in Figures 30 to 39. Figure 30 shows the metabolic rate before and after a neutral bath. This test with the neutral bath was made largely for the purpose of determining any change that might be produced in the metabolic rate by exercise and other factors that are incident to the bath, which, of course, should be eliminated or subtracted from the total changes in metabolism resulting from the short cold bath.

The temperature of the bath in these different experiments varied all the way from 85° to 60°F. and the time from one-half to three minutes. The kind of bath and the temperature and duration of the bath are indicated in each of these charts. It will be seen from a study of these graphic charts that the metabolic rate following a short cold bath was increased all the way from thirty points to one hundred five points. The increase varied with different individuals and with changes of temperature of the water and
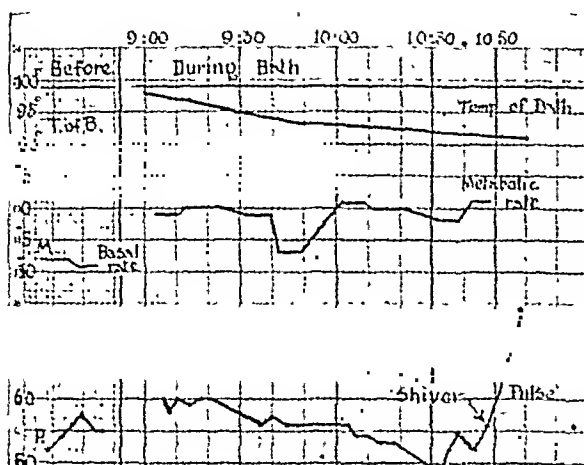
Fig. 30. Physiological effects of neutral bath. Subject: C. B. H. April 18, 1924.
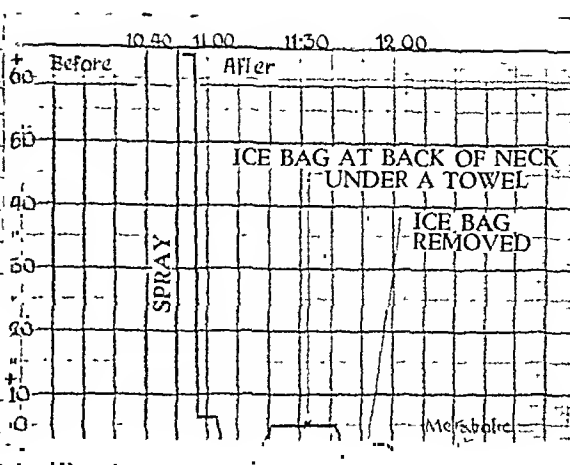
Fig. 31. Physiological effects of spray, 95° to 85° for two minutes. At 85° for one minute. Subject: A. T. C. February 12, 1924.
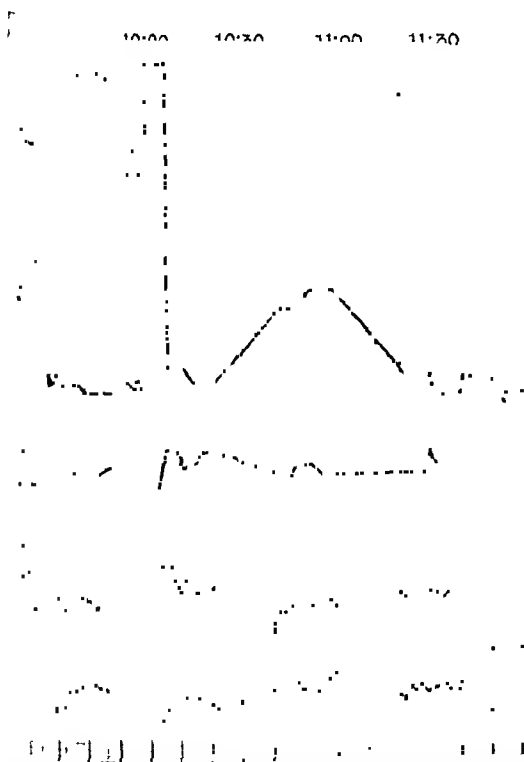
Fig. 32. Physiological effects of bath, 95° to 80° for two minutes. At 80° for one minute. Subject: A. T. C. March 18, 1924.

Fig. 33. Physiological effects of spray, 95° to 80° for two minutes. At 80° for one minute. Subject: A. T. C. February 14, 1924.
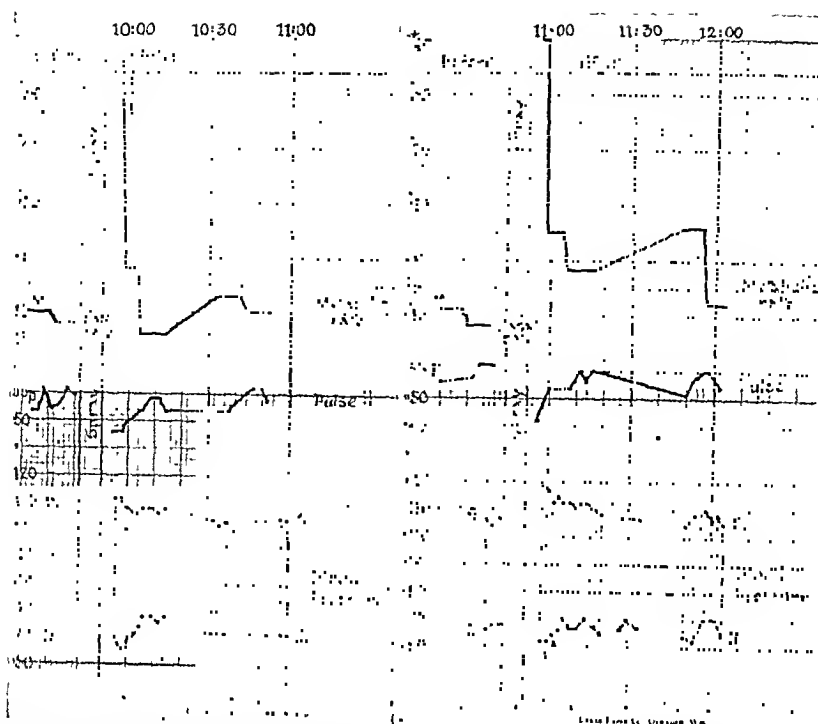
FIG. 34. Physiological effects of spray, 95° to 75° for two minutes. At 75° for one minute. Subject: A. T. C. February 17, 1924.
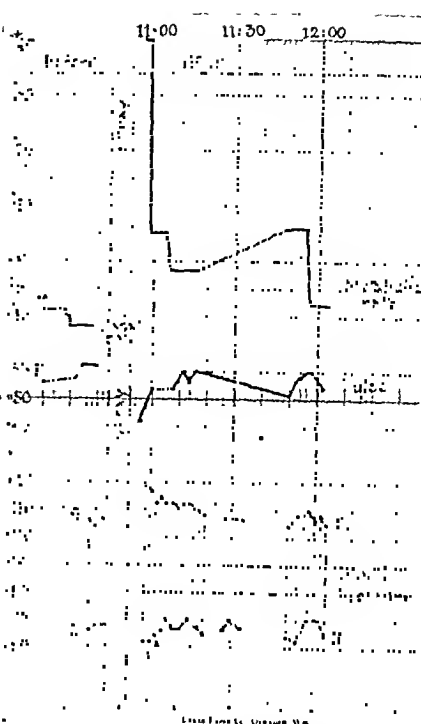
FIG. 35. Physiological effects of spray, 95° to 70° for two minutes. At 70° for one minute. Subject: A. T. C. February 20, 1924.

the length of time that the water was applied, the rule being, the colder the water and the longer the application, within certain limits, the greater the increase in metabolism. The application of cold water in any particular case did not continue longer than three minutes. This very decided increase in the metabolic rate continued for only a short time and then dropped back to normal or near the normal. During this short period in which the metabolic rate is greatly increased the chemical changes going on in the body, of course, are greatly increased and accelerated. More oxygen is absorbed and taken in by the tissues from the blood and entered into chemical combination. The production and elimination of CO_2 is increased. Heat production is also increased. All of this means that the chemical changes going on in the body have been greatly stimulated and increased. The short cold bath thus affords a valuable means by which the chemical changes of the body can be stimulated

and by repeated application brought up to a higher level of activity.

One of the most important functions of the body is that of heat production. Quite often this function, particularly in certain chronic ailments, hypothyroidism, myxedema, and in the later years of life, may be greatly lessened and the fire of the body burn at a lower ebb. In cases of this kind the short cold bath when properly given is a valuable means of increasing the chemical activities of the tissues of the body and thus stimulating heat production. When used for this purpose, of course, it should be repeated once or twice a day over a considerable length of time. There are two ways by which the body may be warmed, one by using the short cold bath and the other by the use of some form of warm bath. When the short cold bath is used heat elimination and heat production are both increased. When the warm bath is used heat production and heat elimination are decreased. In a healthy individual after a strong reaction
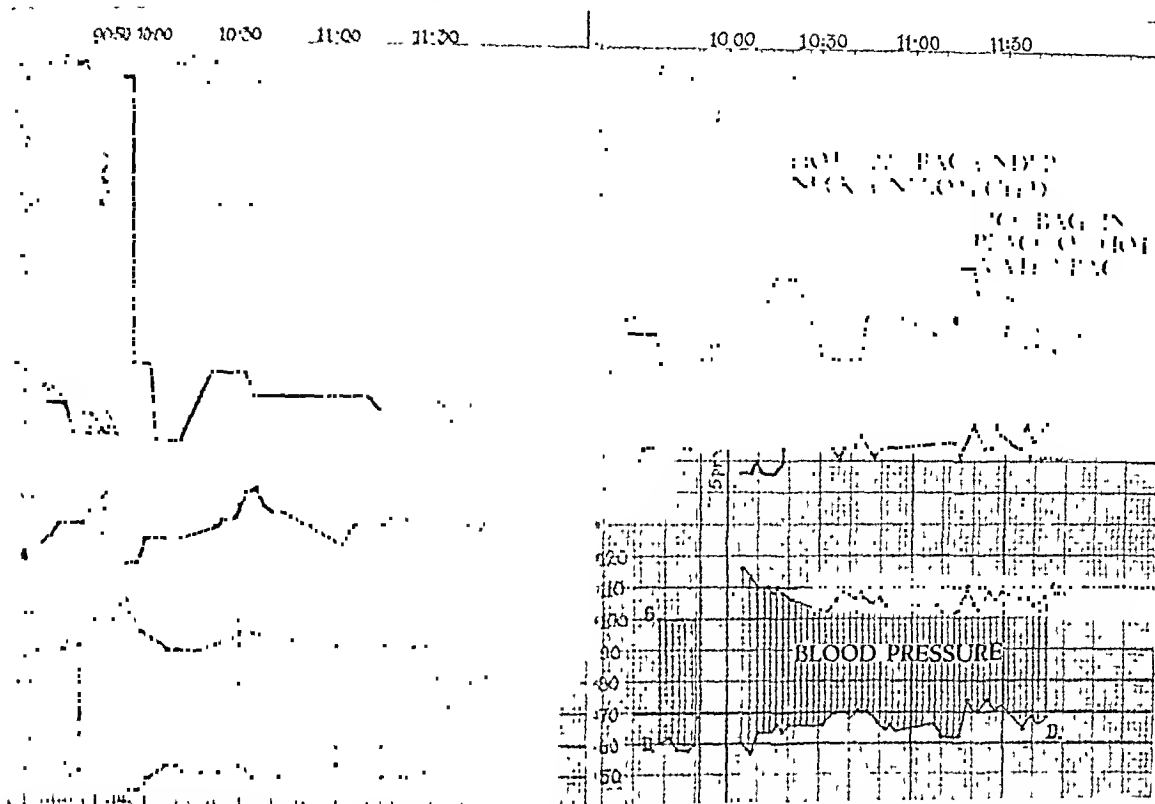
FIG. 36. Physiological effects of spray at 60°F. for one minute. Subject: A. T. C. February 4, 1924.
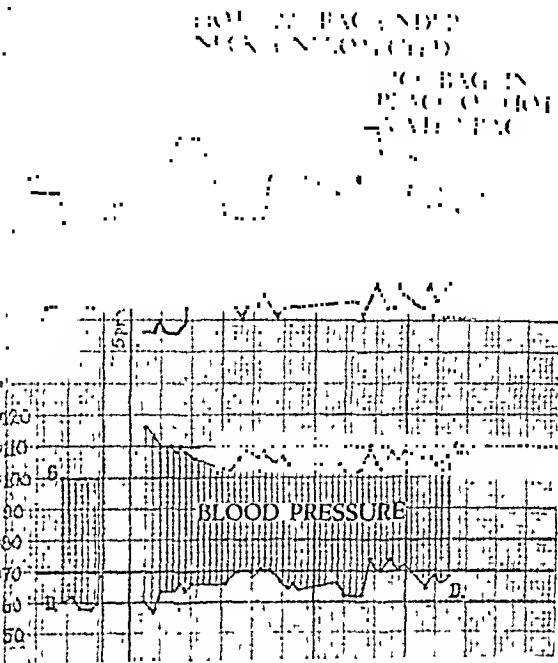
FIG. 37. Physiological effects of spray, 95° to 85° for two minutes. At 85° for two minutes. Subject: A. T. C. February 13, 1924.
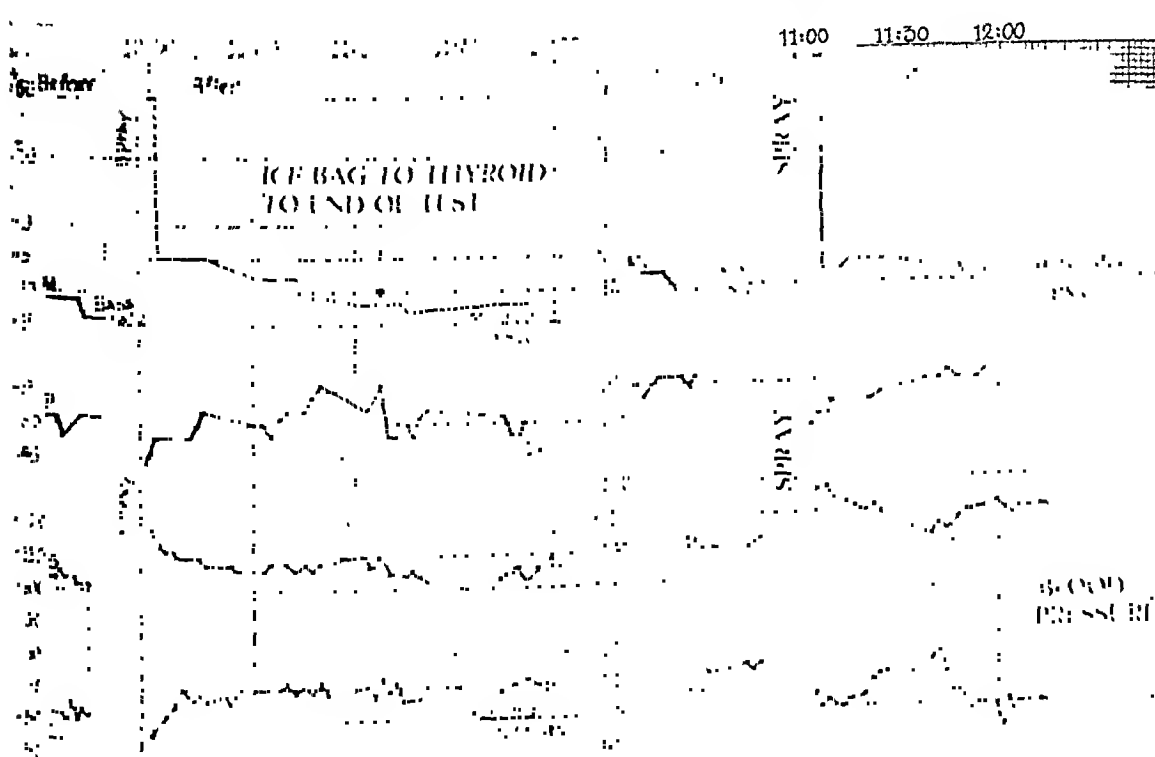
FIG. 38. Physiological effects of spray, 95° to 80 for two minutes. At 80° for two minutes. Subject: A. T. C. February 15, 1924.

FIG. 39. ... for two minutes. At 75° for two minutes. Subject: A. T. C. February 19, 1924.

to the short cold bath, perspiration is often increased as the result of increased heat production and the stimulation of the sweat glands. The short cold bath, therefore, when properly given is a very valuable means of stimulating heat production and maintaining a normal body temperature.

These charts showing changes in the metabolic rate as the result of the short cold bath also illustrate the changes in pulse rate and changes in blood pressure. From a study of these charts it will be seen that the pulse rate is lessened and that the diastolic blood pressure was decreased and the systolic and pulse pressure increased. These changes in pulse rate and blood pressure also varied with the individual and the temperature and duration of the bath; the colder the water and the longer its application, within certain limits, the greater were these changes in pulse rate and blood pressure. Some of these changes in blood pressure were of considerable degree, as illustrated in Figure 39, in which the diastolic blood pressure dropped at least twelve points and the systolic blood pressure increased at least eighteen points, making an increase in pulse pressure of thirty points, which was nearly double the pulse pressure before taking the bath. Since the pulse pressure is a measure of the force of the heart beat, it will be seen that the force of the heart has been greatly increased by the application of the short cold bath. By lessening the rate of the heart beat and increasing its force, the nutrition and tone of the heart muscle are improved. The lessening of the diastolic blood pressure means that the peripheral resistance in the capillaries and arterioles has been lessened and the increase in the systolic and pulse pressure means that the force of the heart has been increased. This lessening of the resistance in the capillaries and arterioles and increasing the force of the heart are very potent factors in increasing the movement of the blood and improving the circulation.

THE BLOOD

These experiments also show that the short cold bath when taken daily and repeatedly for some time increases both the red and white blood cells and the hemoglobin. This increase in blood elements is undoubtedly brought about by an increase in the activity of the blood-making organs of the body and also as the result of stimulating and increasing the function of other organs and stimulating nutritional changes. In dealing with any particular form of anemia, of course, the cause of the anemia should be looked for and as far as possible removed. Other remedies may also be used in addition to the short cold bath.

When the hand or the foot is placed in the cold bath for five to ten minutes or longer, the number of both white and red cells in the blood is greatly increased. This increase in the blood cells as the result of a local application of cold for a short time is undoubtedly due to a greater influx of blood in the blood vessels of the hand or part that has been exposed to the cold water. It does not mean that the total blood cells in the body have been increased in this short time since, of course, this would be impossible. It simply means that there has been a greater movement of the blood to the part of the body that has been exposed to the cold water.

THE DIGESTIVE SYSTEM

The short cold bath stimulates all the different functions of digestion. It improves the appetite, increases the secretion of gastric juice in cases in which it is below the normal and the glands of the stomach are not destroyed. It increases the peristalsis of the stomach and intestines, and is a valuable adjunct in the treatment of constipation.

THE KIDNEYS

Analyses of the urine before and after the short cold bath show that when repeated two or more times daily it increases the function of the kidneys.

After a series of baths the quantity of urine, the total solids, and the amount of urea are all increased. The increase in the total solids and urea are probably also in part due to the increase in metabolism and the chemical changes going on in the body as the result of the short cold bath.

THE NERVES

The first effect of the cold bath is to increase the irritability and conductivity of both sensory and motor nerves and thus improve their function. Prolonged application of cold lessens the irritability and conductivity of the nerves and thus decreases their function.

From what has been stated it will be readily seen that the effect of the short cold bath on the body is to increase the activity of all of its different functions, and because of this it has a very wide application for usefulness and is an excellent tonic. It will not be possible in the present paper to discuss all the different diseases in which its use is indicated, but a few general indications may be mentioned.

It is very useful in all asthenic and neurasthenic states and in all chronic diseases where the different functions of the body are below normal. It is useful in various digestive troubles, constipation, different forms of anemia, and in cases where the circulation is below the normal. It is very valuable in improving vasomotor tone and the tone of the heart muscle and in cases of low blood pressure. There are many individuals who lead a sedentary life and who develop a weak heart muscle and a condition in which the muscle tone of the heart is greatly decreased. A short cold bath repeated daily is one of the best heart tonics when properly used. In cases of severe diseases of the heart, it should be used cautiously and care should be taken that too cold applications are not made in cases where the heart muscle is very weak. It is very valuable where the metabolic rate has dropped below the normal as in hypothyroid conditions, myxedema, and in all conditions where metabolism and oxidation need to be stimulated. It is also valuable when properly used in cases of diabetes mellitus as it will aid in burning up the excessive amount of sugar in the blood. It is also useful in obesity and many other diseases.

A great deal of skill may be shown in prescribing the short cold bath. It is important that the temperature and duration of the bath be suited to the needs of the patient. Too long an application or too large a dose of cold might do harm. The dosage of cold should be measured out by the physician with as much care as he would measure out a dose of medicine for his patient.

CAUTIONS AND CONTRAINDICATIONS

1. A short cold bath should never be taken when the body is cold. In this condition a warm bath is indicated rather than a cold one. It is usually a good plan to take a warm bath before taking a cold bath, or at least to have the body warm. If the body is already warm, it may not be necessary.

2. A short cold bath should never be taken when the body is tired, as it increases the activity of all of the organs of the body and liberates energy. When one is tired his ability to react to the short cold bath is greatly lessened and consequently he cannot get as much good from it as when he is rested.

3. There are certain conditions and diseases of the body where the short cold bath may be contraindicated or should be used very cautiously and in small doses. In conditions of shock and collapse the use of cold is contraindicated. During the two extremes of life, that is, in infancy and old age, cold should be used very cautiously.

4. In diseases of the kidneys the application of cold water to the body should be used very cautiously, and in advanced disease of the kidneys it is contraindicated. There is a very close relation between the kidneys and the skin, and in advanced diseases of the kidneys the application of cold to the surface of the body may greatly interfere with the function of the kidneys.

5. In cardiovascular diseases and arteriosclerosis, particularly in the advanced stages of these conditions, cold should be used with caution and in small doses, also in high arterial hypertension. In patients suffering from an apoplectic stroke or in the hemiplegic state following apoplexy, cold should be used in small doses and cautiously.

6. In hyperthyroidism and in all conditions where the metabolic rate is above the normal, a short cold bath is contra-indicated as this increases the metabolic rate.

In cases where cold should be used cautiously and in small doses a short cold bath may often be used to good advantage in the form of a cold wet hand rub, cold mitten friction and cold wet towel rub, or some other similar mild application of cold. By these methods the tonic effect of the cold may be obtained without aggravating disturbing symptoms.

CONCLUSIONS

A short cold bath increases the circuation and nutrition of the skin, increases muscle tone, increases muscular endurance and capacity, lessens muscular fatigue, increases the force and lessens the rate of the heart beat, increases the tone of the heart muscle, increases the tone and nutrition of the blood vessels, increases systolic and pulse blood pressure, decreases diastolic pressure, stimulates and improves the circulation, increases the depth and rate of respiration, increases the oxygenation of the blood, increases absorption of oxygen, increases the metabolism and chemical changes of the body, increases the production and elimination of CO_2, increases heat elimination and production, increases the number of blood elements and hemoglobin in the blood, improves the appetite, stimulates digestion, increases peristalsis of the digestive tract, helps to relieve constipation, increases the activity of the kidneys, increases the output of total fluid, solids and urea in the urine, increases the normal irritability and conductivity of the nerves, improves nerve tone, and is a general tonic. Its use and contraindications are given.

The American Journal of Surgery

⸙ EDITORIAL ⸙

SOME OBSERVATIONS ON THE PROBLEM OF CANCER CONTROL

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NEW YORK

VERY recently a highly concentrated and powerful effort was made by the officers of the American Society for the Control of Cancer to place before the laity the main facts regarding cancer. The daily press is to be commended for its generous and wholehearted cooperation. The Society is to be congratulated on the success they have had in raising the $1,000,000 endowment which they set up as their goal a year ago. Now there arises the question, and a most important question, of the way in which the income of this fund can be spent that will prove most effective in bringing about a decrease of the steadily rising mortality of cancer or a lessening of the increase of the disease. By such campaigns as the one that has just closed and by widespread distribution of tracts containing important knowledge about the early symptoms of cancer and the importance of seeking early medical or surgical advice and treatment, some patients will be brought to consult a physician more promptly than heretofore. The number of lives saved thereby, however, will have no appreciable effect on the steadily rising mortality. The American Society for the Control of Cancer has been working hard and steadily for more than a decade and a half, but so far there has been no evidence of a decrease in the mortality of cancer. This does not mean that their efforts have been in vain, for without them the mortality doubtless would have been somewhat higher. But it does mean that we should not rest content with efforts merely in the direction

of education of the laity but should extend our efforts along other lines, some of which may prove of far greater promise.

First, more attention should be given to the education of the physician to enable him to make an earlier diagnosis. While not so frequent as formerly, it is still a very common experience with most surgeons to have a patient give a history of having consulted her family physician shortly after noticing a lump in the breast, and being told to apply some simple remedy or to pay no attention to it until it gave her some trouble. In other words, the policy of watchful waiting is still carried out to a much greater extent than is generally believed in the treatment of tumors of the breast and of cancer in general.

The early diagnosis of malignant tumor is often attended with the greatest difficulty even in the hands of experts who have had a large experience with cancer. Therefore, we can hardly expect the general practitioner who sees very few cases of cancer to make an early diagnosis.

The greatest difficulty, and one that still persists in spite of all our increased knowledge of malignant disease and of improved methods of diagnosis, is to be found in the great field of intra-abdominal cancer. Cases without number could be cited to show how very difficult it is to make a diagnosis of cancer of the abdominal cavity sufficiently early to give any hope of a cure by operation or any other form of treatment. When we consider that one-third of all cases of cancer occur in the stomach and liver, to say nothing of those which occur in the rest of the intestinal tract, we see at once what a large proportion of patients cannot be saved by early diagnosis.

If there is any field in which an early diagnosis should be made it is in cancer of the lip, tongue and mouth. The patient is usually aware of the fact that even a small lesion of the mouth or tongue may be dangerous and he usually consults a doctor early. While radium and roentgen ray alone or combined with surgery have undoubtedly enabled us to save more lives in this large field, the prognosis is still very bad.

A study of the statistics of Barker[1] shows that in England and Wales from 1911 to 1920 inclusive, 175,871 males and 224,503 females died of cancer. In more than 60 per cent of the fatal cases the disease attacked the region in or about the alimentary canal. A review of the statistics of the United States registration area shows that in 1924 there were 91,138 deaths from cancer of all organs, of which 12,603 occurred in the peritoneum, intestines and rectum and 34,250 in the stomach and liver. In other words in no less than 46,853, or more than one-half of the total number of cases, the disease occurred in regions in which, even with the aid of an early diagnosis, the chances of effecting a cure by any known method of treatment were exceedingly small.

The laity are constantly blamed for a pessimistic attitude towards surgery and the recognized methods of treating cancer, but if we would stop for a moment and make a careful analysis of the end results of these methods, we might be more sympathetic with this attitude. While we like to estimate the results of operation by the reported results obtained by a few of the most skillful surgeons in special fields, the laity with more reason base their opinion upon the results of operations performed upon persons whom they have known and by surgeons in their own locality; in other words, upon the average results. It is all important that the profession at large should know what these average results are, but thus far the necessary data for determining such results have not been available. Fortunately the importance of obtaining such data is being realized, and one of the first to make a noteworthy contribution in this direction was Dr. Charles L. Gibson[2] of New York, Professor of Surgery, Cornell University Medical College, who published the end

results of 573 cases of malignant disease observed on the First Surgical (Cornell) service of the New York Hospital, from February, 1913 to January 1, 1926, a period of thirteen years. Of 437 patients operated upon, 308 were dead; only 64 were known to be alive and free from recurrence at the time of the report, and only 13 were alive for a period of five years after operation. Dr. Gibson states: "No sadder report of the disheartening status of cancer surgery has come to our attention. It is, however, inevitable, dealing only with facts." He further states:

Before adopting too harsh a conclusion it should be remembered that this paper is practically a unique contribution to the subject. While the total number is not impressive, I find no similar study of the total material of twelve consecutive years and on which a vast amount of personal effort, time and money have been spent in the pursuit of results. Similar research emanating from other institutions would doubtless furnish surprises. We have been living in a fool's paradise of fallacious statistics.

If the results of surgery in one of the leading hospitals of the country and in the hands of surgeons of exceptional experience and skill are so bad, one must conclude that the average results of operation throughout the country must be at least as bad and in all probability considerably worse. After all, perhaps the laity have some ground for the pessimistic attitude about cancer which they still maintain in spite of all our efforts to dissipate it. Although roentgen rays and radium have been of great value in the treatment of cancer, especially superficial cancer, uterine cancer, and in the large field of inoperable cancer as a palliative measure, we are still lacking authoritative data upon which to base an opinion as to the actual curative value of radiation in deep-seated cancer in general, and as Dr. Gibson stated, it is time that a report of the results of radiotherapy, along the lines of his paper, was published.

One month after the publication of Dr. Gibson's paper, we find a report by Channing C. Simmons[3] on Cancer of the Mouth: The Results of Treatment by Operation and Radiation. This report was based on a study of 376 cases observed at the Massachusetts General and Collis P. Huntington Memorial Hospitals during the years 1918, 1919 and 1920. The term "cure" as applied to these cases means those that were alive and free from evidence of the disease for three or more years after treatment. In every case of "cure" by operation, the diagnosis was confirmed microscopically.

The results of 51 operations on primary cases that showed no clinical evidence of metastases are as follows: There was one operative death, a mortality of 2 per cent. Of 25 cases which showed metastases at the time of operation, two died as a result of operation, an operative mortality of 8 per cent and two were not traced. Incomplete operations were performed on ten cases with no cures, and a radical operation was performed on 13, with one cure.

Relative to the results following radiation, in 27 primary cases that showed no evidence of metastases, there were four "cures" (15 per cent). Simmons states:

No pathological examination was made in any of the cured cases. All were of the papillary type and originated in areas of leucoplakia, and the diagnosis of malignancy is open to question. One had a distinct indurated area and was undoubtedly malignant. The other three cases received many radium treatments for recurring areas of papilloma and leucoplakia over a long period of time. One hundred and eight primary cases in which the glands were clinically malignant were treated by radiation. There were no cures. It is perhaps hardly fair to consider all of these 108 cases comparable to the 25 in the corresponding group treated by operation.

Simmons has tabulated his cases as follows:

RESULTS OF OPERATIONS (45 CASES) IN PRIMARY CASES WITHOUT CLINICAL METASTASES

	Dead	3 Year Cures	Per Cent Cures
Tongue.	15	4	26
Floor..	3	1	25
Cheek.	2	4	66
Upper jaw	4	4	50
Lower jaw. . .	4	3	43
Tonsil... . ..	1	0	1
Totals . .	29	16	34.7

"Cures" following radical operation...... 35 per cent.
"Cures" following incomplete operation.. 34 per cent.
Operative mortality (1 case in 51 operations) 2 per cent.

In brief, there were only 20 three-year cures in a total of 376 cases treated (16 treated by surgery and 4 treated by radium).

Comparing these two similar groups of cases, the first treated by operation and the second by radiation, it is seen that in primary cases of cancer of the mouth without evidence of metastases, surgical treatment offers 35 per cent chances of cure, the operative deaths being classed as failures, against at best 15 per cent of cures following radiation treatment. In primary cases with evidence of metastases radiation treatment offers no chance of cure and operation not over 5 per cent.

Among the conclusions reached by Simmons are the following:

1. Cancer of the buccal mucosa is a rapidly growing form of carcinoma and is often incurable in a few months from the onset of the disease.

2. Of the primary cases dying of a recurrence of the disease, life is prolonged by treatment, but the patient lives longer following operative treatment than following radiation treatment.

3. In recurrent cases dying of the disease in all groups, life is longer in the cases which received radiation treatment than in those cases receiving no treatment.

4. A certain group of cases which may be said to have been "cured" by treatment are prone to develop a second cancer at some other point in the buccal mucosa.

These results are of especial importance inasmuch as they represent a large group of cases in the hands of men of exceptional knowledge of modern methods of treating cancer and unusual skill in the application of these methods.

Dr. William C. Clarke of New York, Professor of Experimental Surgery, Columbia University, in a most illuminating address on Common Surgical Procedures; Their Scientific Status in Cancer, delivered before the Brooklyn Pathological Society, October 8, 1925, reviews the end results in 420 cases of cancer of the breast operated upon at the Presbyterian Hospital, New York, from 1910 to 1924.

Clarke laments the fact that while knowledge in the pure sciences rests for the most part upon a strong scientific basis, this is hardly true in medicine. He believes that fixed habit of thought, custom and superstition are numbered among the chief hindrances to progress in clinical medicine and surgery, and that the present procedure in the treatment of cancer is following the pathway of habit. In regard to the treatment of cancer of the breast, he states:

If you have a few patients alive ten years after operation, that by clinical and microscopic examinations were believed to be cancer cases, you are proud. If you have a couple more who have lived for fifteen years you are tickled to death. Few of you know of a patient who, after twenty years have elapsed, is apparently cured. This must mean that you are not so confident that your operation is doing much to help your cancer patients.

Of the 420 cases of cancer of the breast operated upon at the Presbyterian Hospital during the period mentioned, 135 cases were not followed and there were 11 operative deaths. Of the 264 traced cases, 100 or 42 per cent were alive (average postoperative life being fifty months) and 164 or 58 per cent were dead (average postoperative life, 24.3 months).

Of this series, one case has lived fifteen years (cancer of right breast; nine years later cancer in left breast), one, fourteen years; one, twelve years; two, eleven

years; and two, ten years. These seven patients were still alive and well in 1925.

Clarke states that today there is much propaganda published to persuade people to be operated upon at once on the discovery of a tumor, and for frequent physical examination to make the discovery earlier than in the past. He continues:

At the same time much of this propaganda is misleading, the truth is hidden and distorted. The efforts of collecting the follow-up results on operations for cancer will be wasted unless comparisons are possible so that the whole truth may be known. It is true that there has been more intensive research work in cancer than in almost any other field of medicine, but will not these workers be more effective if they are not lulled into complacency believing that the operation for cancer is effective? I believe that the total good which accrues to all patients when all forms of cancer are considered is disappointingly small. I believe that operation makes the majority of cancer cases more comfortable for a period, and affords them a brief mental uplift, unfortunately counterbalanced by the almost inevitable reappearance of their growths. I believe that in a few cases the good is overwhelming; therefore, I believe all should be operated upon and as early as possible, until a better procedure be discovered or until it be discovered which cases should be operated upon and which should not be so treated.

The most serious attempt to ascertain the end results of the surgical treatment of cancer has been made by the British Ministry of Health, under the able direction of Sir George Newman. Reports of various workers are published from time to time. Among the most noteworthy of these are the reports of Dr. Janet E. Lane-Claypon[5] in which she reviews the literature on cancer of the breast and its surgical treatment. We believe that the American Society for the Control of Cancer might well follow the example of the British Ministry of Health, and attempt to get the end results of not only cases operated upon at the leading American hospitals but also those treated by

radiation. It might be better still to follow Dr. Gibson's example and record the end results of treatment of all types of cancer of all localities rather than merely those of special organs.

That cancer is increasing at a most disturbing rate throughout the civilized world is now very generally admitted. For a time there was an attempt made to explain away this increase in various ways, one being the assumption that increased knowledge and greater skill in diagnosis in recent years have added many deaths to the cancer mortality which formerly were attributed to other causes. There is little ground for this theory for the reason that, while the diagnosis of cancer in the early stages of the diseases is often most difficult, the clinical signs of cancer in the ultimate stages are so clear that few physicians could mistake the disease for any other. Again, the increases in the mortality includes all types of cancer, those in the accessible regions where the disease could not be mistaken as well as those in the inaccessible regions where there might be a chance for error in the diagnosis. The theory that more people formerly died in infancy and youth before reaching the so-called cancer age fails to account for more than a small part of the increase in the disease. There has been the same increase in sarcoma which attacks at any age. Recent studies based on an analysis of patients who have reached the cancer age compared with a similar series of those observed at earlier periods show an unmistakable increase and leave us nothing upon which to base a hope that the increase in cancer is fancied rather than real.

Schereschewsky[6] of Boston makes a very interesting and important contribution to the statistics on cancer mortality in the ten original registration states.* According to him, the population aged forty years and over is the important age group so far as cancer mortality is con-

* Trend for the period 1900 to 1920.

cerned. In 1900, in the states under consideration,* this age group furnished about 89.8 per cent, and in 1920 about 92.5 per cent of all the cancer deaths. The population forty years and over of the ten original registration states was 5,313,459 in 1900, in 1920, 8,145,709.

Schereschewsky calls attention to the following table:

PERCENTAGE INCREASES IN DEATH RATE FROM CANCER OF ALL FORMS

	Death Rate per 100,000		Per Cent Increase
	1900	1920	
Cancer, all forms	212.0	311.4	46.9
Buccal cavity	5.5	11.18	103.4
Stomach and liver	77.1	116.2	50.7
Peritoneum, intestines and rectum	19.0	47.2	148.4
Female genital organs*	51.0	84.0	64.7
Breast*	34.4	62.8	82.6
Skin	7.36	9.38	27.4
Other organs or organs not specified	60.75	54.9	9.6 decrease

* Female population forty years and over.

According to Schereschewsky, even a casual examination of the mortality returns over a series of years shows that a pronounced change in the direction of greater precision and detail in the filling out of death certificates must have taken place. He states that while the general death rate in persons forty years and over has shown but little change during the period of observation, the death rate from "ill defined" causes fell during the twenty-one year period from 108 to 5, a decrease of more than 95 per cent. In similar fashion, the mortality rate from senility declined from 185.0 in 1900 to 39.1 in 1920, a decrease of nearly 87 per cent. Undoubtedly many of the cases classified as "ill defined" in later years were reported as cancer deaths.

Schereschewsky reaches the following conclusions:

* Connecticut, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island and Vermont.

1. There has been a pronounced increase in the observed death rate from cancer in persons forty years and over in that part of the United States known as the ten original registration states.

2. Part of this increase (about 30 per cent) is due to greater precision and accuracy in the filling out of death returns.

3. The remainder, however, is an actual increase in the mortality resulting in a death rate between 25 and 30 per cent higher than it was twenty-one years ago.

In discussing Schereschewsky's paper, Frederick L. Hoffman of Newark, N. J., stated:

Last year the rate for American cities was the highest on record, while for certain cities the rates are decidedly alarming. But the root of the matter will not be effectively dealt with until the rate is broken up into its component parts and we deal separately with the different forms and types of cancer that affect the human body. The cancer problem is unquestionably the greatest problem before the medical profession at the present time. It will certainly not be solved by those who spend their time in hair-splitting arguments, chiefly for the purpose of controversy, rather than in aid of the search for cancer facts. The statistical aspects of the cancer problem are extremely complex, burdensome, costly and always difficult, but the outstanding results of statistical research are unquestionably useful contributions to cancer knowledge and aid in the search for a better understanding of the true nature of malignant disease.

It is evident that the laity are becoming more and more interested in the control of cancer, and it might be worth while to consider for a moment some of their views on the subject. In a recent book entitled "Lay Sermons," Lady Margot Asquith[7] in discussing health devotes a brief paragraph to cancer. She states:

When you hear of cancer-houses, you ask about the drains, but it would be more to the purpose to ask about the drainage of the victims than of the building. We may be on the eve of a great scientific discovery in connection with cancer, but in the meantime little is known about it. It is a step forward to learn

in what part of the world certain intestinal afflictions seldom occur, and it is possible that, if people were more observant and at an early stage of cancer could be influenced to tell men of science as much as they could of their diet and habits, it would be more valuable than all the experiments made upon rats and rabbits.

Sir Arbuthnot Lane[8] believes that cancer is largely due to the absorption of intestinal poisons caused by constipation, which would account for the relatively low incidence of cancer in India where the natives live almost exclusively on a vegetable diet and where constipation is almost unknown. While this may be a partial explanation and true as far as it goes, it in no way conflicts with the theory that cancer may be due to a microorganism which finds an unfavorable soil for development in persons living upon a simple vegetable diet, and a highly favorable soil in the tissues of persons living on the richer and more highly proteid diet with greatly increased consumption of salt and sugar of Western civilization. In any event we believe the health campaign inaugurated by Sir Arbuthnot Lane to be of the utmost value in so far as it succeeds in getting a more general adoption of a simpler and more rational diet. This would undoubtedly lead to improvement in general health, and it is not impossible that there would be some improvement in the cancer mortality as well.

In a bulletin issued by the American Society for the Control of Cancer, at the time of the Mohonk conference, September, 1926, it was stated that nothing less than the utmost authoritative and most reliable opinion will suffice to meet the pessimistic attitude of many people who think that cancer is contagious, hereditary and infectious. We note, however, since the recent publication of Maud Slye's[9] elaborate investigations carried on over a period of many years and demonstrating definitely that cancer is hereditary in animals at least, that the earlier views held by the Society have been modified

to some extent, and that they now incline to the attitude that while human beings may not definitely inherit cancer one may at least inherit a greater susceptibility to the disease which amounts to very nearly the same thing. In the light of recent investigations I believe that the views of the Society in regard to the infectious origin of the disease may also have to be modified.

The geographical distribution of cancer, its widely different incidence in comparatively near localities, its low incidence in places where the death rate from tuberculosis is abnormally high and where malaria is usually prevalent all point to an infectious origin of cancer. Its great rarity in countries like India and the tropical portions of Africa also may be best explained on the assumption of an infectious origin of the disease. Its low mortality in these districts may be due to a number of factors, for example, (1) if infectious, the cause may be less common in these localities or (2) these people, whose ancestors have lived for more than a thousand years in the same locality with little or no migration and largely upon a simple vegetable diet with little salt or sugar, may have acquired a natural and inherited immunity to the organism, which immunity is gradually lost by the adoption of the habits and diet of Western civilization. This theory is still further supported by the fact that the natives of these countries have acquired an almost complete immunity to appendicitis and gastric and duodenal ulcer, all of which are due to infectious causes, and this same immunity is lost on the adoption of the diet of Europeans.

Those who have had the largest clinical experience with the various forms of malignant tumors cannot fail to be impressed by the close resemblance between malignant tumors and swellings known to be of infectious origin, for example, Hodgkin's disease, tuberculosis and syphilitic tumors. I have observed numerous cases in which the most experienced

pathologists were unable to differentiate these conditions. Hodgkin's disease is now classified by most pathologists as infectious granuloma and not a neoplasm at all, and yet, lymphosarcoma, which is often impossible to distinguish from Hodgkin's disease, is still classified by most pathologists as a neoplasm, although many have begun to place it among the malignant granulomata. If, then, malignant tumors so closely resemble conditions which are accepted as of infectious origin, is it unreasonable to assume that the tumors still classed as neoplasms may not likewise be due to some unknown infectious cause?

Broussais[10] was one of the earliest and strongest advocates of the idea that tumors are closely related to chronic inflammation, and this view was largely accepted by Virchow,[11] as well as by Jonathan Hutchinson,[12] who said:

The propositions in reference to cancer, which I am chiefly concerned to maintain, are: First, that it is a modification of chronic inflammation, and that the same laws which are applicable to the one are, for the most part, applicable to the other. Second, that it is under the influence of inherited tendency and of senility, that processes inflammatory in their outset tend to pass into those of cancer. Third, that cancerous processes are in their initiation local, and that the disease becomes constitutional by infection, by elements derived from the primary growth.

Roger Williams[13] makes a very elaborate attempt to disprove the theory of the microbic or infectious origin of cancer, and quotes Billroth:[14]

A tumour is a neoplasm that has not started from the same causes as excite inflammation, but from others that are unknown, or but vaguely suspected.

Williams continues:

I think I have already made it sufficiently plain both in this and in other chapters, that my views on this important matter are entirely in accord with those of Müller, Billroth and Cohnhein; indeed, I believe that the Brous-

saisian doctrine of tumour formation is mainly responsible for the comparatively small progress that has been made during the last half-century in tumour pathogeny—this misconception having given a wrong bent to the direction of tumour research . . . For, since inflammation is the outcome solely of extrinsic causes, whereas the causes which determine tumour growth are mainly intrinsic, it is obvious that of these divergent and incompatible ways, only one can be right.

Williams' statement that "the causes which determine tumour growth are mainly intrinsic" is purely begging the question. During the last twenty years, this intrinsic theory has more or less dominated the field of cancer research, and yet have we seen any greater progress in tumor pathology during this period than previously when the theory of the extrinsic origin of cancer held greater vogue? I believe, however, that a reactionary tendency is now noticeable, and that many men engaged in cancer research, especially in clinical cancer research, are again asking if it is not possible that the extrinsic theory may be the key to the hitherto unsolved problem of the origin of cancer. Numerous objections to this theory are still recognized, and yet I believe it is possible to answer most of these objections.

Willy Meyer[15] of New York has stated:

In years past I, also, belonged to the contingent of surgeons who believe in a specific agent of cancer, and hoped it would ultimately be found. Conditions in the latter part of the last century were especially favorable to the fostering of such expectations; it was a time when the discovery of the specific agents of many diseases was the overshadowing event in medicine. We knew then not quite so much of cancer as we do now, and the demonstration of its specific agent appeared in those days not only plausible but also most desirable, because seemingly it would have simplified matters. Moreover, surgeons gravitated naturally to such an expectation by reason of the many instances in which they came upon cases of the most rapid development of numberless metastatic foci, e.g., in miliary carcinosis of the peritoneal cavity where, macroscopically, the

symptoms make it next to impossible to regard the condition as other than infectious. Such experiences made them rather tenacious of their standpoint. But something happened that set me thinking. Ten years ago, when Aschoff was here, I asked him whether he shared Klemperer's[16] just then publicly expressed hope for the ultimate discovery of the specific cancer agent. He replied: "And if you should reach Methuselah's age, you would not have lived long enough to see that happen."

According to Meyer, "no analogy exists between cancer and any known form of infectious or contagious disease. The possibility of transference of cancer cells from one individual to another is non-existent." We know that it is possible to transform cancer cells from one animal to another, and were we permitted to experiment on human beings, no doubt the same would prove true in man. However, it has been frequently pointed out by Sir James Paget[17] and many other clinicians since his day that there is a very close analogy between cancer and other infectious diseases, e.g., tuberculosis and syphilis. This analogy is based not only upon clinical evidence but in many cases microscopical as well, for frequently it is most difficult for the pathologists to differentiate certain tumors of tuberculosis from malignant tumors; the same is true of syphilis. In my own experience, I have observed a patient who had been operated upon for a tumor of the testis. A microscopical examination was made by a professor of pathology of one of the New York medical schools, who pronounced it to be tuberculosis of the testis. When the patient came to me about six months later, he had a large retroperitoneal sarcoma which caused death within a year. In another case that was under my care for a rapidly growing tumor of the scalp, a large-size portion of the tumor was removed and on microscopical examination was reported to be chronic inflammation, probably luetic. This report was made by two professors of pathology of leading medical schools. The clinical progress of the tumor,

rapid increase in size with later metastases, proved it to be a highly malignant sarcoma. These two cases are only a few that might be cited to prove that malignant tumors do have some analogy to tumors of known infectious origin.

Now let us consider another point raised by Dr. Meyer,[15] that is, "that the transference of cancer cells from one individual to another is non-existent."

In the *Annales d'Anatomie Pathologique* Lecène and Lacassagne[18] reported a remarkable case which I believe furnishes the evidence long sought in favor of the theory that malignant tumors may be due to a microorganism or an infectious virus of some sort. They describe their case as follows:

In early February, 1923, a medical student, aged twenty-one years, wounded himself with a hypodermic needle while attempting to draw off a collection of lymph from under the scar of an amputated breast, the operation having been performed eleven days before for cancer. (The disease had already involved the mammary gland and the patient died a few months later.) While the student was aspirating, the patient made a sudden movement of the arm; the syringe fell from the hands of the student, and in trying to catch it, the needle penetrated deeply into the palm of his left hand, at the same time discharging a small quantity of the liquid that was in the syringe. This is the beginning of a very remarkable observation. In three quarters of an hour, the student cauterized the track of the wound with a galvanic current. There was slight limitation of the movements of the fingers for several days but no real pain, and the accident was forgotten for a period of two years. In February, 1925, or two years after the puncture, he began to have diffuse pains in the whole hand; these were especially severe at night. Shortly after he noticed a hard, bosselated swelling at the exact site of the puncture, and along the track of the puncture. In March an enlarged gland the size of a nut appeared in the axilla. This was diagnosed as a tubercular gland as he had had enlarged cervical glands in childhood. The gland was removed and examined but no evidence of tuberculosis was found; it was regarded as chronic inflammation. In

reality, the gland was already invaded by a malignant process, originating in the punctured hand. In June, 1925, the swelling of hand became stationary. In July, the skin became invaded and thereafter ulcerated. On August 4th, under ether anesthesia, the tumor of the hand was excised, in view of the previous report on the gland process which was believed to be inflammatory or tubercular. A local recurrence developed and grew rapidly, and there was no longer any doubt of the malignant nature of the condition.

By September 15th, four nodules had appeared in the skin of the forearm, showing a generalization of the process. On September 23, the arm was removed by disarticulation at the shoulder, with complete dissection of the axillary glands.

A careful histological examination was made by Dr. Horrenschmidt, who examined (1) the axillary glands removed in April, 1925, (2) the primary tumor of the hand removed in August, 1925, (3) the nodules of the skin of the forearm, (4) the recurrent tumor of the hand and (5) the glands of the axilla removed on September 23, 1925. All these specimens showed the same general structure and were identical with the primary tumor of the hand which was diagnosed as a spindle cell sarcoma. The histology of the tumor of the breast from which the serum was obtained was that of an atypical carcinoma.

Lecène and Lacassagne stated that several hypotheses were offered in explanation of this case:

A. The possibility that there was a transmissionary graft of cancer cells, which had been cultivated in the collection of serum and introduced into the operator's hand by the needle puncture. In explanation of the change from one variety of cancer to another, the following were offered:

1. The tumor of the hand was an actual sarcoma that had undergone transformation from epithelial cells—a phenomenon that has been observed by Ehrlich and Apolant in certain grafts in rats.

2. The tumor of the hand was in reality an externally atypical epithelioma which had the histological characteristics of a sarcoma, brought about by developing upon new soil.

B. That the transmission of cancer is accomplished by the inoculation of a virus analogous to the filtrable virus admitted by Gye, possibly of an infectious principle analogous to that admitted by Garrel. The change in the histology of the type of the tumor is entirely "conciliable" with this hypothesis.

C. That there was no transmission of cancer at all but the development of a malignant tumor du novo at the site of the wound was caused by the hypodermic needle and the cauterization pathway.

The authors believe the last hypothesis to be quite inadmissible. Personally I believe the second hypothesis to be the most correct one.

Eight months later, Gye[19] of London published a new hypothesis on the etiology of malignant tumors which created worldwide interest. In brief, he claimed that the cause of malignant tumors in both man and the lower animals is a microorganism which is filtrable and cultivatable on proper media, and is visible by means of a specially constructed microscope, but which by treatment with a solution of chloroform may become incapable of producing malignant tumors unless the resistance of the tissues of the host is lowered by the introduction of some other cellular product or agent characterized as a "chemical stimulant" or "specific factor." In other words, he held that the microscopic agent or virus of the Rous chicken sarcoma which had been passed through a Berkefeld filter and had been devitalized by chloroform to such an extent that its power to produce tumors on inoculation had been completely abolished, by the addition of some special agent or "specific factor" could be reactivated and have restored to it its power to produce tumors on inoculation.

Other independent investigators who have failed to obtain the same results as Gye explain their failure on the ground that some of the living organisms have passed through the Berkefeld filter and that the amount of chloroform used was insufficient to completely destroy these organisms, and that the tumors which Gye succeeded in producing by this

filtrated and treated culture had their origin in these living organisms and were not the result of any particular action of a "specific factor."

Even if Gye's theory should prove incorrect—and thus far the evidence presented by other investigators has failed to fully confirm it—it would not mean that his work had been in vain. The idea behind his hypothesis still remains the most plausible explanation of the etiology of cancer. The idea of a "specific factor" or agent coincides in an almost uncanny way with our present meager knowledge of the etiology of malignant tumors.

At a symposium on cancer (Clinical Congress of American College of Surgeons, New York, October 20–26, 1924) with reference to the etiology of the disease, I stated[20]:

If we assume an extrinsic origin of cancer, it is easy to understand that this organism may be very widely distributed over the world, that everybody is exposed to it, and yet that it requires a soil peculiarly fitted for it to obtain a firm hold in man and to produce a cancer. I do not believe that the question of favorable soil has ever received due recognition in discussion on the etiology of cancer. During the World War the Imperial Cancer Research Society of Great Britain had the members of its staff devote their entire time to the study of infections, abandoning for the time their research work in the field of cancer. A most important paper on The Mechanism of Bacterial Infections, with Special Reference to Gas Gangrene by two of these workers, Bullock and Cramer,[21] appeared in 1919. In it they state that very many wounds, especially those received on the Western front, were infected with Bacillus welchii, but only a very small percentage of those infected wounds developed gas gangrene. The same thing was found to be true in animals; of some hundred mice and guinea pigs injected with Bacillus tetanus only 2 per cent contracted the disease. It was found, however, that doses of 2.5 mg. of calcium chloride, when injected subcutaneously into mice of 10 to 15 gm. weight, together with a suspension of a virulent strain of Bacillus welchii or *vibrion septique*, will produce a violent gas gangrene in every case.

The assumption is that a malignant tumor is due to a microorganism, e.g., an organism somewhat similar to the virus of a Rous sarcoma, and that this agent is ordinarily of such a low degree of virulence that the normal body cells are sufficiently resistant to prevent it from producing a malignant tumor until in some way another quite independent factor is brought into play corresponding to the "specific factor" of Gye, which, either by lowering the resistance of the body cells or increasing the virulence of the organism, makes possible the production of a malignant tumor. This other agent may vary widely in character; it may be some form of chronic irritation which, by lowering the vitality of the cells, makes it possible for the infectious agent to obtain a foothold and start a proliferation of cells which later results in a malignant tumor. On the other hand, this agent may be a single trauma causing some hemorrhage or some slight bruising of the tissues which in some way destroys the delicate equilibrium of the cells and thereby furnishes suitable soil for the development of a malignant organism. Or again this agent may be some chemical change in the body fluids brought about by a change of diet, which may act as a specific factor.

As stated before, the lack of complete confirmation of Gye's laboratory experiments does not materially weaken the theory presented. Perhaps he tried to prove too much. In dealing with the problem of human cancer we do not need to go as far as to assume that the microbic agent is actually destroyed but that it is simply reduced in virulence. We need only assume that the body cells normally have such a high degree of resistance to the infection that it is harmless until this resistance is broken down by some of the factors mentioned. We may never be able to produce in the laboratory the exact conditions that obtain in the human body, but from what we do know of the possibility of breaking down the resistance

of certain microorganisms by simple chemical changes in the body fluids, it is quite permissible to assume that similar changes may be brought about in the development of malignant tumors.

It must be conceded at the beginning that the supposed microorganism that is assumed to be the cause of cancer differs from all known types and must not be judged by the same criteria. It should be permissible to assume that we are dealing with an infectious agent that differs from any of the more common types of infection, and that the clinical manifestations or tumors produced by this agent may differ materially from ordinary inflammatory conditions. We might be permitted, still further, to assume this agent to be ultramicroscopic, at least in certain stages of its development. Granting it were an intracellular organism would explain the hitherto unknown reason why a metastatic tumor of the liver in primary cancer of the rectum should show the same type of cells as the primary tumor instead of being made up of liver cells. We may even assume that a single microorganism may under certain conditions produce a proliferation of epithelium cells resulting in a squamous carcinoma in one case and in another, under different conditions, resulting in a lymphosarcoma. We know that the late Professor Erwin H. Smith[22] of the Bureau of Plant Pathology, Washington, by varying the site and depth of his inoculations, was able by the use of a single microorganism to produce different types of malignant tumors in plants.

It is likewise possible to assume that we may be dealing with a certain closely allied group of organisms, morphologically perhaps very similar but producing widely different clinical manifestations, such as the different types of streptococcus which, though morphologically identical, clinically give rise to wholly different types of infections, such as erysipelas, scarlet fever and cellulitis.

We talk a great deal about chemical irritants and trauma as the principal exciting causes, and there is no doubt that they are the chief exciting causes, but behind these immediate and exciting causes there may lie, and, in my opinion, there certainly do lie, other and antecedent causes such as some obscure factor that lowers the natural resistance of the body cells to the causative agent, whatever it may be. If this causative agent should prove to be some form of infection, as many of us believe it to be, it is easy to understand the very marked variations in the geographical distribution of cancer which have never been satisfactorily explained on any other theory. It is well known that in certain native races cancer is so rare that it is almost unknown, and further and more important, it has been stated by Sir Arbuthnot Lane[6] and by surgeons who have lived in India for many years that the English residents there have the same high cancer mortality as that which obtains in England. Furthermore, and of exceeding interest and importance if true, it has been stated that Indian natives who adopt the habits and diet of the English likewise acquire the same high cancer mortality. While this statement has been questioned by some writers, it has been reaffirmed by others. In a recent letter to the editor of *The Lancet*, H. Hallilay[23] writes as follows:

The population of Punjab consists of roughly 22,000,000 people. The immensely larger proportion of this population is concerned, either directly or indirectly, in the cultivation of the soil. Their diet consists of wholemeal bread and dal, varieties of pulses, with large quantities of cooked and uncooked vegetables, and many varieties of fruit. . . . Speaking as a surgeon who has practiced and lived amongst these people for the past twenty-five years, I can testify to the great rarity of such diseases as appendicitis, gastric and duodenal ulcer, gallstone disease and visceroptosis amongst them, and, finally, to the infrequency of cancer in any of its forms. I wish it to be understood that I am referring to the agricultural and pastoral tribes of the Punjab and not to the literate and clerical classes,

many of whose members have departed in a greater or less degree from the simple habits of their forefathers.

The most complete and authoritative proof of the fact that cancer is extremely rare in India and neighboring countries, particularly Ceylon, may be found in W. Roger Williams'[24] book on The Natural History of Cancer in the chapter on Geographical Distribution and Incidence. He states that, according to Davidson[25] cancer is very rare in Bombay, only 0.1 per 1,000 of the total deaths being due to this cause. Furthermore, that

Among the natives of Ceylon, malignant tumours are very rare, the death-rate from this cause in 1897, being 5 per 100,000 inhabitants, or 1 in 563 of the total deaths . . . According to Sir A. Perry[26] the cancer mortality in 1903 was 1 in every 16,820 persons living, or about 6 per 100,000 inhabitants. The island is highly malarious.

In Burmah and Siam, malignant tumours are perhaps rather more prevalent than in India. During four years' residence in Siam, Gowen[27] met with a few cases of carcinoma and sarcoma, but Rasch never saw a single case of sarcoma there.

Among the Laos people, who occupy the region to the north of Siam, Hansen[28] found that malignant tumours were very rare. In three years' practice he met with only a single case.

Dalgetty[29] states that during his five years' work in Adampore in South Sylhet, among a laboring population of 12,000 Hindoos imported from various parts of India to work in the tea-gardens, he observed only eight cases of malignant disease. Six of these were cancer and two were sarcoma. Among 15,000 Mohammedans of the same region, but all of whom were resident natives rather than imported, only three cases of malignant tumor were observed in a period of five years.

Behla,[30] who for twenty-two years made a most careful study of the house incidence of all cancer deaths in Luckau (which has a stationary population of 5,000) found that about 1 in 25 of the total deaths were due to cancer. The most remarkable point brought out by his investigation is that in the central part of Luckau, which is low-lying and surrounded by ditches (comprising 3,000 inhabitants), there were 65 deaths from cancer, while in the eastern suburb, Kalau, which is also low-lying and marshy, being intersected by irrigation canals for market gardening (comprising 1,000 inhabitants) there were 73 cancer deaths, or 1 in 9 of its total mortality. It is very hard to imagine a sufficiently great variation in the mode of living and character of diet in people living in such close proximity to account for this great variation in mortality. In striking contrast with the foregoing, the high-lying and dry suburb of Sando (comprising 100 inhabitants) had not a single death from cancer during the whole period covered by Behla's study. It is extremely difficult to explain these striking variations in the death rate of cancer, but in my opinion, the facts just presented point almost conclusively to an infectious origin of cancer, and that this infectious agent is found more often and in more virulent forms in some localities than in others that may be so near as to be almost contiguous.

While Roger Williams[31] does not hesitate to report these and similar studies in full detail, he passes over them lightly in his final conclusion with this remark:

As against these weighty considerations, the curious medley of chaotic and conflicting statements advanced by the advocates of infection in support of their thesis seem to me to be of little worth. We need not seriously entertain these fairy tales, until their great progenitor, the hypothetical microbe of cancer, has been discovered.

This is the very same argument that was used in connection with tuberculosis, which disease was regarded by the laity as infectious centuries before the tubercle bacillus was discovered by Koch.

Although most of these statistics are comparatively old, dating back twenty

years or more, they are practically all confirmed by the recent and most valuable work of Dr. Frederick L. Hoffman,[32] Consulting Statistician, The Prudential Insurance Company and Director of the San Francisco Cancer Survey. His paper on Cancer in Native Races contains a large amount of new and most important data on incidence of cancer in various countries.

With regard to Africa, he states:

According to *The Medical Journal of South Africa*, of April, 1925, Watkins Pitchford,[33] reporting upon cancer among natives in Natal and Zululand, remarks, "During the four years from 1906 to 1909, eight deaths from cancer were reported among the whole native population of 930,000, giving a crude death rate during the period of approximately 0.2 per 100,000 per annum. For the same period the average yearly death rate from cancer among the Indian immigrants was approximately 11.9 and among the Europeans 57.5. The native death rate per thousand from all causes was 13.2, which no doubt is an understatement. The cancers were of the breast, liver, stomach, male generative organs, while one was a sarcoma of the shoulder."

Mr. J. Ellis Barker[34] has brought together a considerable amount of valuable data on Cancer and the Black Man in an article contributed to the *Fortnightly Review* of March, 1925. It is work of this kind that is likely to prove valuable in the course of time. He emphasizes the point that "the key of the cancer mystery is to be found in the fact that cancer is a disease of civilization, that it is most prevalent in the most civilized nations, and that it is extremely rare in those primitive races which lead primitive lives."

Of particular value is a quotation from the *Zeitschrift für Krebsforschung* in which Dr. von Hansemann[35] describes the malignant tumor material which was sent from the German colonies to Germany for microscopic examination. "It is generally known that malignant epithelial tumors are almost completely absent in the case of uncivilized negroes. I have never seen a case of cancer among the negroes of Cameroon, and only four cases of sarcoma."

In 1924 I was favored with a report from Dr. A. J. Orenstein, Superintendent, Department of Sanitation of Rand Mines, Limited,

Johannesburg, South Africa, who writes me in part as follows:

"It may be of interest to you to know that such cancer as we see among natives employed on the mines is carcinoma, and usually of the liver. In fact, Dr. Pirie has formed the opinion that bilharzia infection might have something to do with it. Another curious feature is that this carcinoma seems to attack natives in the third decade of life. . . . Perhaps I may express my personal opinion that so far as South African natives are concerned, carcinoma is not the unknown disease that some writers would lead us to believe.

"In their own villages the vast majority of natives live on the following staples: maize in the form of meal or as cooked grain; a certain amount of milk; various grasses and herbs, cooked; peanuts now and then; millet now and then; meat on infrequent occasions among most tribes, but when eaten it is usually consumed in large quantities at one sitting. One might almost say that meat eating partakes of the nature of an orgy.

"On the mines the daily ration consists of: maize meal, 24 ounces; bread ($2\frac{2}{3}$ wheat, $\frac{1}{3}$ maize), 6 ounces; beans or peas, $1\frac{1}{2}$ ounces; meat, $8\frac{1}{2}$ ounces; peanuts or fat, about 2 ounces; sugar, 1 ounce; salt, coffee or cocoa and usually kafir beer, about 6 ounces. . . . Canned provisions are not consumed as a regular ration on the mines, although the more civilized natives are rather fond of buying canned tomatoes and sardines, but these articles cannot by any means be said to constitute an important portion of the dietary."

Under date of January 5, 1924, the Chief Sanitation Officer, Dr. Paterson, of the Medical Department of Nyassaland, writes me from Nairobi:

"The most that can be said is that both sarcomata and carcinomata have been observed among the non-European populations, that the diagnosis has been confirmed by microscopical examination with regard to both classes of tumors and that both sarcomata and carcinomata would appear to be very much rarer among the native populations than among Europeans."

According to a statement in the *Annals of Tropical Medicine*, Liverpool, 1923, based on an article on Malignant Growths in West African Natives, by Adler and Cummings,[36] it has been alleged that malignant growths in West African natives are rare. Adler and

Cummings report seven cases; five of these occurred in aborigines and two in creoles. The tumors were melanotic sarcoma, epithelioma on scrotum, epithelioma of lip, meningeal sarcoma, primary carcinoma of the liver and secondary carcinoma of the liver.

This statement is of exceptional interest in that it supports the view that while cancer does occur among South African natives, broadly speaking, it is chiefly of a sarcomatic type or, if a carcinomata, affects the liver. The latter infections it is said are as a rule complicated by liver fluke which may be of direct parasitical origin. It is regrettable that the subject should not have been more carefully considered.

Of exceptional interest are the statistics of our native Indian population as now compiled annually by the Division of Vital Statistics of the United States Census. They are unfortunately limited to the Indian population of the registration states and concerned chiefly with Indian tribes more or less in contact with white civilization. They represent, however, approximately the mortality of an Indian population of about 100,000.

During the four years ending with 1924 there have been 214 deaths from cancer among this population in a total mortality of 8,851, equivalent to 2.4 per cent. In the normal white population the proportion of cancer deaths is approximately from 7 to 10 per cent. Out of 4,487 deaths of males, 74 or 1.6 per cent were from cancer, while out of 4,364 deaths of females, 140 or 3.2 per cent were from cancer.

If it is assumed that the aggregate population was approximately 350,000 during the period under review, this would give an approximate cancer death rate of 60 per 100,000. But as pointed out previously the fact must not be overlooked that the major portion of this population is in comparatively close contact with white civilization and has adopted largely the customs, manners and diet of white people.

A most important contribution to the subject of cancer death rate variations in relation to combustion, products of fuel, topography and population has very recently been made by Jerome Meyers,[37] of New York. The study covers not only different localities but even different districts in the same locality, and includes many valuable statistics on the cancer death rate in different parts of Europe as well as in the United States. The greatest value of this survey lies in the new and original data obtained in regard to the cancer death rate of the Borough of Richmond during the period of from 1914 to 1920 inclusive. All deaths from carcinoma, sarcoma or other malignant growths were individually noted by name, street and number, age, sex, nativity, birthplace of mother and father and length of residence on Staten Island. All cases that seemed of doubtful diagnosis, all that had died in institutions, all cases that could not show a residence on the island for a period of at least three years before the time of death were excluded. A total of 515 deaths at all ages from malignant diseases in the period mentioned (1914–1920) formed the basis of the survey.

Meyers states that in order to study the influence of topography on cancer incidence Staten Island was divided into thirteen districts, comprising a population of 100,000. It was found that the death rate in these districts varied from 42.1 per 100,000 to 78.9. In the elevated central part of the island, the death rate was found to be only 42.9, while in level ground districts backed by elevated, the rate was 69.6. The district showing the highest rate on the island lies in a distinct cup or depression surrounded toward the south and southeast by low-lying hills. According to Meyers, it is therefore not only exposed to smoke but presents a topographical condition making for increased death rates.

Among Meyers' conclusions are the following:

1. There is a marked and interesting variation in cancer death rates in different countries, within countries and states and probably even in different sections of cities.

2. There may be an etiological relation between the incidence of cancer and topography. Open level districts, of high or low altitude, show lower cancer rates than land in hollows or depressions or intersected by gullies, valleys, or lying against adjacent hills. Albany and San Francisco should make interesting studies.

3. There may be an etiological relation between the combustion products of coal and oil and cancer. Those sections of Staten Island exposed to smoke fumes and gases show a higher cancer death rate than those not so exposed. House-heating and chimney ventilation are also important, as gases and fumes from these sources may bear a relation to cancer incidence as found in our districts.

4. Whatever may be the possible errors in this study of a comparatively small number of cases (515), it cannot fail to show variations in cancer death rates even on an island thirteen and one-half by seven and three-fourth miles, divided into 13 districts, and these variations would seem in the light of our findings to bear a relation to etiological factors of fuel and topography. These conditions therefore would seem to be a part of the complex etiology of cancer.

The first things one naturally thinks of in comparing the diet of the people of such countries as England and America with that of the natives of India are (1) the former live largely on a meat diet, the latter on a vegetable diet, (2) the former consume a large and increasing amount of sugar while the latter use only a very small amount and (3) the former consume a much larger quantity of salt than do the native races of India or Africa. Salt is so scarce in the interior of Africa that it has been stated that many natives willingly sell themselves into slavery to be taken to the coast where they can get salt.

Recent experimental research work in Berlin and Vienna would seem to give some weight to the theory that possibly the steadily increasing quantity of sugar consumed by the people of the West might have some relation to the steadily increasing cancer incidence. According to Warburg, a Berlin chemist, animal cancers are nourished by the grape sugar content of the blood. Rona and Deutsch have recently demonstrated that similar proceedings take place in human beings suffering from cancer.

It is well recognized that in the presence of a hyperglycemia, pyogenic infections tend to spread with great rapidity and produce early septicemia unless radical surgical measures are adopted early.

The recent laboratory investigations of Sugiura and Benedict[38] on the influence of insufficient diets upon tumor recurrence and growth in rats and mice, are of great importance and strongly support the theory that diet may play an important role in the etiology of cancer. The conclusions reached by these authors are worthy of wide publicity. They are as follows:

1. Transplants of the Flexner-Jobling rat carcinoma in rats fed on a complete basic diet but limited in quantity to one-third of the normal food requirement survived less frequently and grew much more slowly than those of full-fed controls.

2. Underfeeding after engrafted cancerous grafts had well established themselves in hosts had no marked inhibitory effect upon the subsequent rate of tumor growth.

3. Prolonged postoperative insufficient feeding had a distinct influence upon the frequency of recurrences of spontaneous tumors in mice. About 73 per cent of the underfed mice were completely cured of the tumor. On the other hand only about 18 per cent of the normally-fed controls were free from tumors at the time of death.

4. The number of new primary tumors subsequently developed or metastases found at autopsy were less in the underfed animals than in the full-fed controls.

5. The interval between the operative removal of spontaneous tumors and the development of local recurrences was delayed and the subsequent rate of tumor growth was diminished in the insufficiently fed animals.

6. The average postoperative longevity in the underfed mice was one hundred and forty-two days against ninety-six days for the full-fed controls. The gain of forty-six days in the experimental animals corresponds to about three and eight-tenth years of a man's life.

In view of the evidence presented by recent research workers, I believe we are justified in assuming that some simple change in the chemistry of the blood brought about by a change in diet, such as a greatly increased amount of salt or sugar, might have a very material effect

in lowering an individual's resistance to the unknown infectious microorganism that may be the cause of cancer, just as by the addition of a little calcium chloride to the body fluids of normal animals it has been found possible to break down their resistance to the tetanus bacillus and other infections (gas bacillus or streptococcus) and produce a serious, fatal infection that, without such addition, would have been harmless. This theory may prove without foundation but there are enough facts to justify us in taking the trouble and expense necessary to prove or disprove it. Should it prove true we have a working basis; then we could find what kind of food destroys or weakens the natural immunity to cancer and so modify our diet as to increase our resistance to the disease. This would be a great step forward in the control of cancer. In addition to these investigations every effort should be made to discover the cause of cancer for until this is known we believe there can be no real control of the dread disease.

While it has long been recognized that cancer and tuberculosis seldom occur in the same individual, only comparatively recently has the fact been brought to attention that there is an extremely close relationship between the incidence of the two diseases, and that while the death rate of tuberculosis has been steadily declining there has been a corresponding increase in the mortality of cancer. The question naturally arises whether there is any causal connection between the two diseases or whether we are dealing with a mere coincidence. A most careful study of the subject has been made by Dr. Thomas Cherry[39] of Melbourne who states:

A suggestive feature in recent reports on public health from many parts of the world is the steady decline in the number of deaths from tuberculosis and the equally steady advance of cancer. In the first English records, more than eighty years ago, this reciprocal movement was already apparent, but at that time cancer was quite unimportant as com-

pared with phthisis. By 1855 the phthisis rate had fallen to 2600 per million, and the cancer rate had advanced to 320. The two rates are now about equal in England and Wales. The changes which have taken place in the past thirty years and the percentage reduction and increase in the respective rates in each five year period are as shown below.

MORTALITY RATES PER MILLION LIVING

Periods	Phthisis	Percentage Reduction	Cancer	Percentage Increase
1871–5	2217	....	445	
1876–80	2038	8 2	494	11.0
1881–5	1830	10.1	548	11.0
1886–90	1635	10.6	632	15.3
1891–5	1461	10.6	712	12.6
1896–1900	1323	9.4	800	12.3
1901–5	1218	8.0	867	8.4
1906–10	1106	8.4	939	8.3

The history of tuberculosis in England shows that it was very prevalent during the early part of last century. In some localities hardly a family could be found which was not affected with the "strumous disposition." After allowing for some exaggeration in such generalizations there can be little doubt that the high figures of all the early annual reports are fully justified. With the marked improvement in food supply and the slower amelioration of the other conditions, recovery from a definite attack of phthisis would become more common. In some cases a high degree of immunity might be developed without the occurrence of a recognized attack of phthisis. Let us suppose that frequent contact with tubercle bacilli develops powers of resistance in the individual and makes him more or less immune to the infectious cause of cancer. The same may be true in regard to the influence of the malarial organism.

Various writers on different occasions have mentioned incidentally the fact that malaria was extremely prevalent in the district under observation. In view of the known influence of the inhibitory action of other infections upon malignant tumors, e.g., the streptococcus of erysipelas, it would seem by no means impossible that the malarial organism through high temperature reactions and other changes in the blood might exert a similar inhibi-

tory influence upon cancer, if not sufficient to produce a marked effect upon the actual development of a malignant tumor, at least to the extent of producing an immunity to the disease in patients suffering from malaria.

While it is almost the universal rule for scientists to make light of popular beliefs, especially in the field of medicine, until they have been completely and satisfactorily explained scientifically, it is curious how many of these beliefs are proved true in the end. In an article entitled The Savage as Scientist, the author, "Fulahn,"[40] makes the following interesting observations:

The discovery that general paralysis, a disease symptomized by the degeneration of the tissues of the spinal cord and brain, and hitherto regarded as incurable, can be cured by inoculating sufferers with malaria, has been hailed as one of the most remarkable triumphs of medical research since Sir Ronald Ross, thirty years ago, discovered the connection between malaria and mosquitoes.

Yet more than four hundred years ago witch doctors in the kraals of one Kitandu, then metmi or chief medicine man of the Iramba tribe, a peaceful pastoral race of savages who, to this day, live on the Daua Plateau in Tanganyika, had not only discovered that malaria was a cure for general paralysis, but they were prescribing mosquito-bite as a medicine for paralytic patients in exactly the same manner as Harley Street specialists are doing in this twentieth century of progress and enlightment.

Harley Street, having no malarial swamp at its door, brings mosquitoes to its patients. The witch doctors of the Iramba send their patients to the mosquitoes. Otherwise the treatment does not vary a hair's-breadth!

So that, when medicine man Mgendu urged Chief Kinga to move from Mandi on the plateau down to Sekenke in the plains and then afterwards to eat bitter roots, that half-naked savage doctor was prescribing the most up-to-date medical treatment for paralysis, based on the most recent discoveries of medical science.

Mandi on the plateau, being 5,000-odd feet above sea level, is practically free from mosquitoes and malaria; but Sekenke, 2,000 feet lower down in the plains, stands in the middle of a swamp, and is one of the worst malarial districts in all Africa. At Sekenke Chief Kinga could not fail to get bitten by mosquitoes, to contract malaria, the germs of which would fight with the germs of his paralysis; then he could eat bitter roots, in other words, "a few doses of quinine."

My conclusions in brief are as follows:

1. Every means, similar to those already adopted by the American Society for the Control of Cancer, should be employed to encourage early recognition of malignant tumors as well as prompt and proper treatment of them. This entails not only continuous propaganda to persuade the patient to consult a physician as soon as a tumor is discovered, but, and what is more important, entails greater effort in educating physicians in the difficult field of the diagnosis of malignant tumors.

1. A considerable portion of the funds raised for cancer control should be expended in the field of collecting more facts, especially more accurate first-hand information as to the geographical distribution of cancer, and especially data that may account for the wide variation in incidence.

3. Cancer research, both clinical and laboratory, should be encouraged in every possible way, by grants if necessary to certain selected hospitals and laboratories. I believe it far better to give such grants or financial assistance to institutions already founded and possessing clinical and laboratory staffs that it has taken years to gather together and train than to attempt to start new institutions.

4. I believe that the work of Gye along the lines of the infectious nature of cancer should receive further and intensive investigation, since it is along these lines that the only real hope of ever obtaining efficient control of cancer lies.

5. A systematic attempt should be made to obtain a thorough follow-up of all patients treated for malignant disease in the leading hospitals of the world, and the end results should be published, thereby giving the public and the profes-

sion some definite ideas of the percentage of malignant tumors that are actually cured or, at least, well for a period of five years. Such information is lacking except in some special fields of cancer treated by men of exceptional experience and skill.

6. Little advance may be expected in the surgical treatment of cancer, but in the field of roentgen ray and radium I believe that, with increasing knowledge of the action of these agents and with improved technique, considerable advance may be anticipated. It is not improbable that in special fields, e.g., cancer of the cervix, radium may soon become the method of choice as it has already become in superficial and skin cancer.

7. A further study of the treatment of inoperable tumors, especially sarcoma, by bacterial toxins should be carried out. If it is found that a considerable number of these cases beyond hope from any other method of treatment can be cured by toxin treatment, and that in many operable cases in which the toxins have been used as a prophylactic after operation, a larger percentage of patients have remained well for five years, then this method should receive more general adoption.

8. The unpublished work of Torrey and Kann on the treatment of tumors with bacterial proteolytic ferments (to be read at the forthcoming meeting of the American Cancer Research Society), carried out under the auspices of Huntington Fund for Cancer Research and the Cornell laboratories, shows the bacterial treatment of tumors to be a very promising field for cancer research and one that has by no means received the attention it deserves.

9. The results of study by these various organizations and individuals' working on the cancer problem, including both the clinical and laboratory aspects, should be given wide publicity. At least every three years there should be an international cancer congress, bringing together the leading workers in cancer and furnishing an opportunity for an interchange of ideas.

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ERRATUM

In "The Surgery of Pain," by Drs. William Francis Honan and Samuel Alcott Thompsons which appeared in the May, 1928, issue of the JOURNAL, the legend appearing below Figures 1 and 2 should have been placed below Figures 3 and 4 and the legend appearing below Figure, 3 and 4 should been placed below Figures 1 and 2.

[From Fernelius' Universa Medicina, Geneva, 1679.]

BOOKSHELF BROWSING

OBSTETRICS ONE HUNDRED YEARS AGO

A REPORT OF 500 CASES RECORDED FROM 1809 TO 1825 COMPARED WITH A RECENT SERIES

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NEW YORK

FROM 1809 to 1825 there was a lying-in ward in the New York Hospital. After several changes this old service evolved into the Obstetrical Division of the New York Nursery and Child's Hospital.

In the record room of the New York Hospital there is a well-preserved book in which the obstetrical cases were registered consecutively. These cases were tabulated under various headings and in the column under "Remarks" many interesting notes were made (Figs. 1, 2 and 3). This record is so complete and its reading so fascinating that it is well worth publishing. It is probably the oldest and best record of early obstetrics in this country. These cases have been grouped and the notes transcribed verbatim to preserve their character. Comparison has been made with the work done at the New York Nursery and Child's Hospital during 1927.

During these seventeen years from 1809 to 1825, 508 cases were admitted and 469 of them delivered. These cases were referred to the hospital by "The Visiting Committee" and were truly indigent. Most of the 38 cases not delivered were discharged "by request" and a note on one such case explained that

"By the elopement of a drunken husband this woman was compelled to seek refuge in this house and now by the return of the same vagabond she is compelled to leave it undelivered."

So probably in those days the women went to the hospital for confinement only when they had no home. However, the following note on another case shows that the advantage of the hospital was recognized.

CASE 450. "In this case the waters had come away on the evening of the 8th. The physician who was called in had attempted turning but in vain. She was therefore sent to the hospital on the 9th about noon . . ."

MORTALITY

The maternal and fetal mortality figures are surprisingly low despite there being no knowledge of infection, no prenatal care, no nursing, very little operative aid, and in fact none of the present refinements. There is much evidence of nice judgment and conscientious effort. The house physician's devotion is illustrated in Case 111, one of long labor. The note reads:

"Labour continued 72 hrs.—hard time for Charley (Dr. Chas. D. W. Hasbrouck)—could not go out on the 4th."
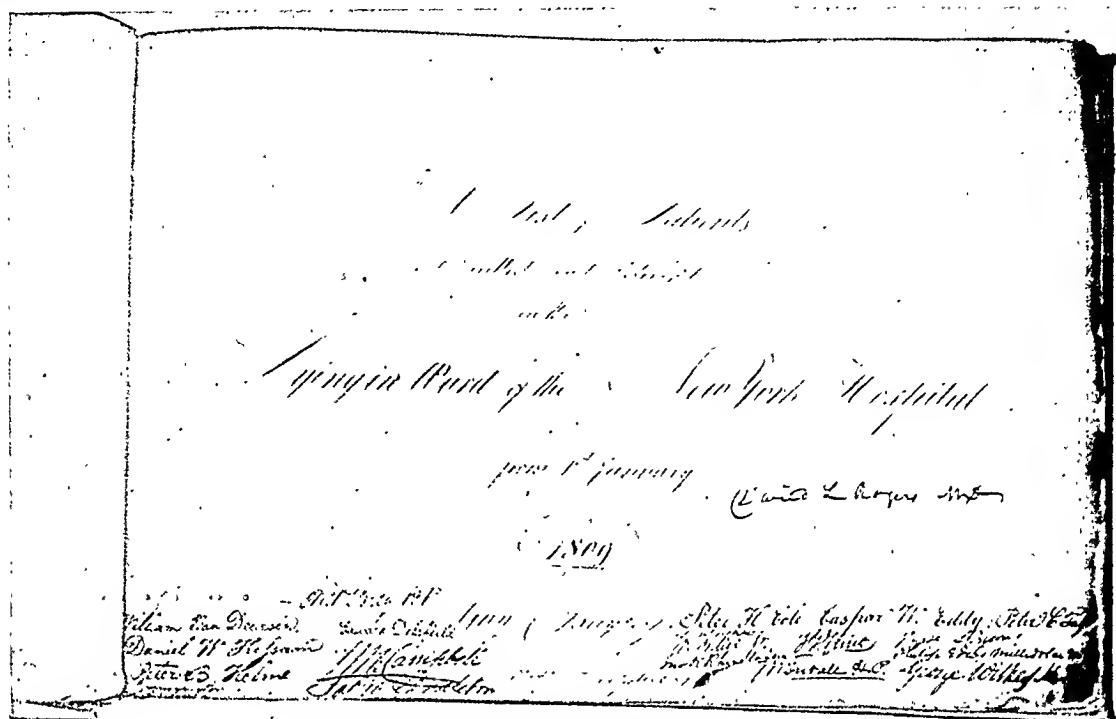
FIG. 1. Title page, showing signatures of the house physicians.

FIG. 2. First page, showing arrangement of the cases.

FIG. 3. Page showing additional columns and "remarks."

The case was admitted July 4, 1813 and delivered July 6th.

MATERNAL MORTALITY

There were twelve maternal deaths (2.5 per cent). In 1927 at the New York Nursery and Child's Hospital, over one hundred years later, there were six deaths in 2,425 cases (0.247 per cent). It is interesting to note that the last twelve deaths on the same service occurred in 4,646 cases during the years 1926 and 1927. It is also interesting to compare the causes of death.

OLD SERIES (1809–1825)

Puerperal fever, 6 cases.

Convulsions, 2 cases; one complicated by cough, probably pneumonia.

Abscess of liver, 1 case (present before delivery).

Fever and delirium, 1 case (onset twelve hours before delivery).

Cause not stated, 2 cases; probably sepsis.

RECENT SERIES (1926–1927)

Pernicious vomiting, 1 case (five months undelivered).

Pneumonia, lobar, 1 case (following cesarean section).

Peritonitis, 3 cases (one due to sloughing fibroid, two following puerperal infection).

Meningitis, 3 cases (two tuberculous, one following old otitis media).

Rupture of uterus, 1 case (following version and extraction).

Fractured skull, 1 case (jumped from fourth story window).

Mesenteric thrombosis with ileus (non infective), 1 case.

Postoperative hemorrhage, 1 case (from varicosities of broad ligament following cesarean).

The original case reports of the deaths in the old series were as follows:

1. CASE 141. "Transferred from the Medical Dept. . . . After delivery her symptoms continued to increase until death (delivered June 28, 1814, died July 2, 1814). She was examined. An abscess in the left lobe of the liver was discovered which contained about a pint and a half of yellowish green matter.

Find her case at large in the medical case books. The child was transferred to the Alms House and died two days after."

2. CASE 167. "About 12 hr. previous to delivery this person was attacked with fever and delirium which continued during the whole period of labour. She died with apoplectic symptoms about 24 hr. after the birth of the child."

3. CASE 189. "Dead." No notes. Aged twenty-six. Delivered April 5, 1815, died April 13, 1815.

4. Case 192. "Dead." No notes. Aged twenty-one. Delivered March 24, 1816, died March 27, 1816.

5. CASE 220. Aged thirty; first child. "This patient died four days after delivery of puerperal fever. On examination the uterus was found slightly inflamed and its inner surface lined with coagulating lymph." Died, December 3, 1816.

6. CASE 225. Aged eighteen, first child. "This patient died of puerperal fever five days after delivery," December 16, 1816.

7. CASE 276. Aged twenty, first child. Delivered February 8, 1818. "This patient was attacked with puerperal fever on the 13th and died in the typhoid state nineteen days after delivery. The child lived but a few days and died of convulsions."

8. CASE 350. "Born in France, aged 20 years, was taken in labour of her first child at 9 o'clock P.M. of the 1st December, 1819. On examination the os uteri was found dilating and the head presenting at the upper aperture of the pelvis. Her pains were frequent and shortly became violent and continued to recur at short intervals till 11 A.M. of the 2nd when perceiving her face flushed, her pulse strong and full & she complaining of indistinctness of vision at the return of every pain she was bled to 14 oz. with relief to the above symptoms—in $\frac{3}{4}$ of an hour she was attacked with convulsions. She lay upon her back—her teeth clenched upon her tongue, her face and neck turgid with blood & of a purple colour. The pupils of her eyes dilated to their full extent & her features shockingly distorted. Her temporal artery & a vein in her arm were immediately opened. She bled freely from both and after the loss of about 30 oz., of blood partially recovered from the first attack—which was quickly followed by a 2nd & 3rd attended with more convulsive action & distortion of countenance than the 1st. The blood was permitted to

flow freely from both orifices & a common injection thrown up the rectum—which was repeated 3 times without effect. She was now immersed in a warm bath and suffered to remain in it for 15 to 20 minutes. She now became quite easy—her pupils contracted to their natural size and she continued to doze for 20 or 30 minutes. Previously to going into the bath & while in it she took about 2 drachms Tinct. Opii when she had another distinct convulsion. The other temporal artery was opened and the blood allowed to flow freely. The head had now advanced near enough to the external orifice to admit the use of the forceps & as labour had been for some time stationary and the contractions of the uterus seemed unequal to delivery but merely sufficient to excite convulsion it was determined to proceed to instrumental delivery as the last means of safety to the woman. Dr. Tappen applied the forceps and after the exertion of some force succeeded in delivering her of an uncommonly large dead child. In the course of an hour the placenta came away & she passed a comfortable night. She did extremely well till the 17th Dec. when she was attacked with cough & expectoration which increased rapidly and on the 25th terminated her existence in Ward No. 6 whither she had been transferred a short time before."

9. CASE 354. "Sally Ann Martin—age 30 was attacked at the commencement of labour with convulsions. She was immediately bled to 30 Oz., from the arm and temporal artery which relieved her from the first attack. The second convulsion subsided after the loss of XV Oz., more of blood. On examination found the os tincae beginning to dilate. She now took 15 gr. Calomel & had a cathartic enema administered which operated freely—15th hour had another convulsion more violent than the preceeding from which she recovered after the loss of 24 Oz., of blood from the temporal artery. She now took in divided doses 2 drachms Tinct. Opii and remained free from convulsions for about 10 hours, when she had another slight attack. The os uteri was now considerably dilated and the membranes beginning to protrude. 1 drachm Tinct. Opii was now administered. At the 30th hour she was delivered of a female child apparently dead but which was resuscitated by immersion in the hot bath & the performance of artificial respiration. A bandage was applied to the abdomen of the woman who now lay in a comatose state.

The placenta came away in about an hour—sinapisms were applied to her feet and an injection administered—her breathing became stertorous—her pupils contracted & she could not be sufficiently aroused to swallow anything. She remained in this state for 8 or 10 hours (supposed effects of opium) when she was attacked with another convulsion which was quickly followed by two more. Dr. Watts now ordered her to be bled & 14 oz., blood were taken from her arm. Her head was shaved and cloths wet in snow water constantly applied. Sinapisms were applied to her chest & legs but without effect. She died at 10 P.M. of Jan. 17, 1820."

10. CASE 358. "This woman received a fright about four weeks before delivery. On Monday, Feb. 7, 1820 at 11 P.M., she was awakened from her sleep by a sudden gush of water to which succeeded occasional uterine pains. On Tuesday at 9 P.M. she was delivered of an uncommonly large child, stillborn after suffering severe and almost incessant pains for eight hours. As soon as the breech and inferior extremities were delivered the arms were extricated and brought down—which prepared the way for the head—but this was resisted and could not be delivered short of 30 min., after all prudent means at extraction. She experienced much pain and distress through the night, notwithstanding she had taken a large anodyne. The placenta was left 14 hours and then it required to be taken away in consequence of flooding. On Wednesday evening she was seized with a severe rigor which lasted for 10 minutes. On Thursday pulse quick & small amounting to near 180 strokes in a minute—skin hot & dry—headache plus slight delirium—bowels costive—lochia profuse—but little pain in the hypogastric region—recession of milk—rigors recurring at irregular intervals followed by profuse perspiration. She died on Monday the 14th Feb. at 9 A.M. Treatment—The bowels were kept freely opened by salts, castor oil and calomel—aided by occasional enemata—skin relaxed by the Aq. Ammon. Acet. united with Mist. Efferves., and a liberal use of warm diluent drinks. Formentations were early applied to the region of the uterus and mammae and as soon as much pain and tenderness were evinced a blister applied to that part of the abdomen—room kept dark & quiet as possible: during each rigor she took plentifully of warm teas."

11, 12. CASES 506 and 507. "These women

died of puerperal fever accompanied with violent typhoid symptoms which resisted every medication that could be suggested."

Two autopsies were done in the old and four in the recent series.

FETAL AND NEONATAL MORTALITY

The total fetal and neonatal mortality was 41 or 8.7 per cent, tabulated as follows:

Still-births, 26
- Normal, 21
  - Term, 21
  - Premature, 0
- Abnormal, 5
  - Term, 5 (macerated)
  - Premature, 0

Deaths, 15
- Normal, 15
  - Term, 12
  - Premature, 3
- Abnormal, 0
  - Term, 0
  - Premature, 0

There were 26 still-births of which 5 were macerated. All were presumably at term as none were stated as being premature.

The fifteen neonatal deaths occurred from a few hours to fifteen days after birth. Nine died during the first week, two on the fifteenth day and three had no record of the length of life. Three babies were premature. The list of neonatal deaths may not be complete, as the condition of the baby on discharge of the mother was not mentioned in several cases. Ten babies were noted as sickly when discharged.

The causes of the still-births were

- Breech presentation................ 9
- Macerated........................ 5
- Version.......................... 1
- Convulsions in mother............. 1
- Long labor....................... 1
- Unknown and not stated........... 9

The causes of neonatal deaths were

- Convulsions...................... 2
- Syphilis......................... 2
- Circulatory disturbance........... 1
- Erysipelas....................... 1
- Prematurity...................... 2
- Not stated and unknown........... 7

Correcting the still-births and neonatal deaths to normal babies at term we find there were 33 or 7 per cent. (In 1927 there were 51 or 2.1 per cent.)

The total fetal and neonatal mortality in 1927 in 2,420 viable births (28 wks.)

was 135 or 5.57 per cent. All deaths within thirty days are included.

Still-births, 77
- Normal, 41
  - Term, 32
  - Premature, 9
- Abnormal,* 36
  - Term, 13 (8 macerated, 5 monsters)
  - Premature, 23 (19 macerated, 4 monsters)

Deaths, 58
- Normal, 48
  - Term, 19
  - Premature, 29
- Abnormal,* 10
  - Term, 9 (monsters)
  - Premature, 1 (monster)

* 27 macerated and 19 monsters.

The larger percentage of abnormal and premature babies in the recent series is noticeable.

PRESENTATIONS

(No mention was made of position.)

- "Head"..................... 446
- "Brow"..................... 1
- "Face"..................... 1
- "Transverse"............... 3
- "Breech"................... 16
- "Hand"..................... 6
- Not stated................. 5

478 deliveries

Nine sets of twins.

PARITY

No record was kept of the parity in the first half of the series. In the last 254 cases 109 were primiparae and 145 multiparae.

DELIVERIES

- Spontaneous................474
- Operative..................4 (0.8 per cent)

During 1927 on the same service there were 1,015 operative deliveries in 2,420 births (41.57 per cent). These include cesarean sections, breech extractions, versions and forceps. (Many of the latter were elective.) Practically all the 2,420 viable births were carried on under anesthesia.

SEX

- Males....................... 225
- Females..................... 246
- Not stated.................. 7

OPERATIONS

There were no cesarean sections. In 1927 there were 65 cesarean sections, an incidence of 2.75 per cent.

There was one forceps delivery, done in the interest of the mother, in a case of eclampsia. The baby was presumably dead before the forceps were applied (vide Case 350 under maternal mortality). No mention is made of fetal heart or of craniotomy anywhere in the series. In 1927 the incidence of forceps was 34.2 per cent in 2,420 viable births.

There were two versions ("Turning").

CASE 12. "Hand presentation—Dr. Seaman turned the child & delivered it—stillborn." Mother recovered.

CASE 435. Under post partum hemorrhage. Case of twins, second baby. "A profuse flooding coming on the hand was introdueed into the uterus, the membranes ruptured and the child turned and delivered by the feet in the usual manner." Mother and babies lived.

In 1927 there were 49 versions in 2,420 births an incidence of 2 per cent.

There were sixteen breech cases. The expression "breech extraction" is not used and only one breech delivery was described. It would be classified now as a breech extraction. Presumably others were extracted. The fetal mortality was 9 (56 per cent). In 1927 there were 87 breech cases. Seventy-three extractions with a gross mortality of 18 (20.6 per cent).

MANUAL REMOVAL OF THE PLACENTA

The placenta was removed manually eighteen times either on account of retention or hemorrhage. There was only one death; this was due to sepsis (vide Case 358, under maternal mortality). This surely is a most remarkable record considering the ignorance of infection and lack of anesthesia. In 1927 the placenta was removed manually five times with no mortality.

No mention was made of induction of labor or of episiotomy.

COMPLICATIONS

Hemorrbage. There were 9 cases of bleeding, 3 ante partum and 6 post partum. The only death (vide Case 358 under maternal mortality) occurred from sepsis after removal of the placenta fourteen hours post partum for "flooding." This, too, is striking in the absence of asepsis and without the use of packing, bags, pituitrin, hypodermoclysis infusion, transfusion and cesarean section. In 1927 there were 5 cases of placenta praevia, 12 of premature separation of the placenta and 22 of post partum hemorrhage of varying degree. There was no death in these groups.

CASE 253. "At the commencement of the pains considerable hemorrhage occurred which ceased on the spontaneous rupture of the membranes and the labor went on naturally. The placenta remained attached to the uterus for some time and was not taken away from the vagina for five hours owing to the very great soreness of the external organs. On the third day this woman was attacked with Puerperal Fever. She was bled, blistered, purged, took an emetic and had several enemas administered. She was much relieved by the remedies mentioned, but at the expiration of twenty-four hours the pain returned accompanied by a profuse uterine hemorrhage which proceeded to an alarming extent and was finally arrested by iced water. The violence of the disease appeared to be checked by this critical evacuation and the patient soon happily recovered." Discharged after thirty-five days, mother and baby well.

CASE 256. "This patient menstruated regularly every month during her pregnancy, hemorrhage occurred in the early part of labour which was arrested by rupturing the membranes. On the 10th day after delivery the hemorrhage returned, various remedies were used but not succeeding. The Spt's of Turpentine was used which completely succeeded." Discharged after twenty-five days, mother and baby well.

CASE 396. "Placenta over the os uteri. The woman was attacked with violent pain accompanied by profuse hemorrhage." Discharged after eleven days, mother and baby well.

CASE 126. "After delivery she had profuse hemorrhage followed by fever—unable to nurse the child for the want of milk. Child transferred to the Alms House." Mother discharged as cured after twenty-five days.

CASE 134. (Vide multiple pregnancy.) Placentae removed for flooding. Mother and one child discharged well.

CASE 358. (Vide maternal mortality.) Placenta removed fourteen hours post partum for flooding. Mother died.

CASE 259. "On the eleventh day after delivery a profuse hemorrhage came on which was checked by cold applications. Nourishing diet and the internal use of Sulphuric Acid removed the debility and restored the health of the patient."

CASE 264. "Three quarters of an hour after the delivery of the child a profuse hemorrhage came on owing to a partial separation of the placenta. From the necessity of the case the hand was immediately passed into the uterus which excited its contractions and forced the placenta into the vagina; which with a large quantity of coagulated blood was expelled by the next pain and the hemorrhage immediately ceased." Discharged after seventeen days.

CASE 292. "Immediately after the birth of the child very violent flooding took place, so much so as to require the immediate delivery of the placenta. The hand was passed into the uterus which caused it to contract and force down the placenta into the vagina where it was left for half an hour and then removed. No hemorrhage succeeding." Discharged twelve days after delivery.

CASE 435. "In this case the presentation & birth of the first child was natural. After tying & cutting the cord, on laying the hand on the abdomen it was evident there was another child, and on examination the two hands were found presenting through a second set of membranes. A profuse flooding coming on, the hand was introduced into the uterus, the membranes ruptured and the child turned and delivered by the feet in the usual manner. The hemorrhage still continuing, the hand was again introduced and the two placentas (which with their membranes were entirely distinct) taken away—one after the other. Then the uterus contracted & the flooding ceased. The woman having become very faint from loss of blood was roused by a little stimulus; & with the aid of an anodyne passed a comfortable night." Discharged cured, length of stay in hospital not stated.

ECLAMPSIA

There were three cases of convulsions, one post partum and two ante partum.

The two latter died. The cases are beautifully described. It is interesting to note that no mention of urinalysis is made. The treatment was modern in as much as opium was freely used. In 1927 in 2,425 cases there were four cases of eclampsia on the private service but none on the public service, with no deaths.

CASE 273. "This patient was attacked with hysteria and convulsions on the fifth day after delivery which was relieved by bleeding, blistering and opium. The cord was around the child's neck. It is necessary to observe that this woman did not get any sound sleep for 72 hours after delivery in consequence of being disturbed by the patients in labour."

This is a good observation of the necessity of labor rooms. This patient was discharged on the twenty-first day post partum.

CASES 350 and 354. (For both cases vide maternal mortality. They are well worth reading.)

There was no mention of cardiac cases, deformed pelves or of tumors. In 1927 there were 28 cases of cardiac disease, 132 deformed pelves of varying degree, 19 fibroids and 2 ovarian cysts.

MULTIPLE PREGNANCY

There were 9 sets of twins with no maternal mortality. Two babies were lost. There were notes on two of the cases.

CASE 99. "Difficult labour. The anterior fontanelle was the presentation of the male. The female presented naturally."

This was evidently an observation of poor flexion.

CASE 134. "Presentation knee & head. The child's head locked for several hours in the upper straight. In consequence of which the circulation in the cord was interrupted. Profuse hemorrhage after delivery of the child—both the placentae extracted—one from the cervix—the other from the fundus." Mother and one baby well. Discharged on twenty-fifth day.

The note on this case was very meagre. As the first baby, a still-birth, was a breech

presentation and the second a vertex, this was probably an example of partial locking of heads.

PROLONGED LABOR

There were 14 cases of labor lasting forty-eight hours or more, one case in 33. There was no maternal death and but one still-birth. No operative work was done, meconium and fetal heart were not mentioned. These cases worry us now but we have a better knowledge of the causative factors. We group them under posterior position, cervical dystocia, deformed pelvis, etc., and treat them accordingly. However, we have no satisfactory way of artificially completing dilation and effacement of the cervix. The recent development of the use of rectal analgesia in labor is one of our most important aids in the management of these cases. It relieves pain, gives rest and conserves strength while moulding, dilation and rotation are occurring.

There were six cases in which the labor was of forty-eight hours duration, one of fifty-two, one of fifty-three, one of sixty, two of seventy-two, one of seventy-five and two of ninety-six. The still-birth happened in one of the latter.

There were a few notes.

CASE 66. "The labour continued 75 hr."
CASE 85. "Labour continued 53 hr."
CASE 111. "Labour continued 72 hr.—hard time for Charley—could not go out on the 4th."
CASE 133. "Labour continued above 48 hr."
CASE 330. Aged twenty-six. "This woman was of a very weak and feeble constitution and pregnant with her first child. Labour pains came on about the full period & were at first strong. The waters broke in a few hours & the head presenting naturally could be felt. Her pains continued altho not so strong & it was not until the expiration of 72 hours that delivery was accomplished. The child was well altho the head was much distorted. Her strength was supported by light vegetable diet & an anodyne was given here." Discharged on forty-sixth day.

The average age was twenty-four years. All except 4 cases had prolonged stays in the hospital varying from sixteen to forty-eight days. The parity was stated in only 8 cases, 4 were primiparae and 4 multiparae.

During 1927 in 2,425 cases there were 30 instances of labor lasting forty-eight hours or longer, one in eighty. There was no maternal death. The morbidity, 100.4 for twenty-four hours, was 5 cases (16 per cent). The average stay in the hospital was thirteen days. Three cases had prolonged stays, sixteen, eighteen and twenty-three days respectively. There were 27 primiparae and 3 multiparae. The average age was twenty-nine. These cases, occurring once in eighty times and selected from 2,425 cases as being truly hard, long labors, no doubt are a more difficult group than the old series of 14 occurring in 469 cases. Six of the 30 had spontaneous deliveries. Three had cesarean section, one classical, one peritoneal exclusion, and one Latzko. Twenty were delivered by forceps, and one by version. The fetal mortality was 8, 4 still-births and 4 deaths summarized as follows:

1. Para 1, aged twenty-four, fifty-five hours labor, spontaneous birth. Baby died after twenty hours.

2. Para 1, aged twenty-one, forty-eight hours labor. Arm prolapsed following bagging. Version and extraction. Still-birth.

3. Para iv, aged forty, fifty-five hours labor. Three living children. Rigid cervix following amputation. Baby died during labor.

4. Para 1, aged thirty-five, sixty-five hours labor; contraction ring concealed prolapse of cord. Baby dead, mother exhausted, cervix not fully dilated, high forceps. Wassermann 4 plus.

5. Para 1, aged twenty-seven, seventy-one hours labor; meconium and failing fetal heart. Forceps delivery with rim of cervix present. Baby died after two days.

6. Para 1, aged twenty-nine, seventy-three hours labor; meconium and slowing fetal heart. Forceps delivery with rim of cervix present. Baby died on second day.

7. Para 1, aged twenty-seven, forty-nine hours labor; forceps for maternal exhaustion.

No cervix present. Baby died after ten hours. Intracranial hemorrhage.

8. Para 1, aged thirty, sixty hours labor; funnel pelvis, fully dilated five hours; rapid fetal heart; still-birth.

In 5 cases there was the difficulty of signs of fetal danger when the cervix was not completely dilated and effaced. These cases occurred in the group who were allowed to labor a long time in expectation that they would be delivered vaginally, as most of them were. No disproportion had been discovered. When signs of fetal or maternal danger appeared, delivery was required even though the cervix was not quite ready. Further labor was hopeless. Earlier interference might have been better but labor was allowed to continue in hopes the cervix would finally be effaced naturally. The more frequent use of incision of the cervix may have to be considered in this situation.

RETAINED PLACENTA

There were 22 cases of retained placenta. It was removed manually in 16 cases after a varying length of time and in the remaining 5 it was expelled spontaneously. There was one maternal death following manual removal. In 1927 there were 4 cases of retained placenta, and it was removed manually three times with no deaths. In this complication the results in the old series were excellent. It is a troublesome question now and much may be learned from studying these cases.

1. CASE 27. "The placenta came away twenty hours after the child was born." Discharged on fifteenth day.

2. CASE 124. "The placenta after being retained three hours was removed." Discharged after seventeen days.

3. CASE 131. "The placenta was taken away after being retained one hour & a half." Discharged on twelfth day.

4. CASE 134. "Both placentae extracted—one from the cervix—the other from the fundus for profuse hemorrhage after delivery of twins." Discharged on twenty-fifth day.

5. CASE 163. "The placenta was taken away 14 hours after the delivery of the child." Discharged after forty-four days.

6. CASE 190. "Placenta taken away by hand 2¼ hours after delivery." Discharged on twenty-seventh day.

7. CASE 191. "The placenta was taken away by introducing the hand into the uterus 2¼ hours after delivery." Discharged after thirty-five days.

8. CASE 193. "At the end of 2 hours the hand was introduced to take away the placenta but the uterus had the hour glass contraction which had to be overcome." Discharged after seventeen days.

9. CASE 195. "Placenta taken from the uterus 2 hours after delivery." Discharged on fifteenth day.

10. CASE 198. "Placenta taken from the uterus 2 hours after delivery." Discharged on eleventh day.

11. CASE 209. "Placenta extracted 2¼ hours after delivery." Discharged on thirtieth day.

12. CASE 222. "The placenta was extracted 3 hours after delivery of the child." Discharged on twelfth day.

13. CASE 253. "The placenta remained attached to the uterus for some time & was not taken away from the vagina for five hours owing to the very great soreness of the external organs—Puerperal fever attacked her on the 3rd day." Discharged on the thirty-third day.

14. CASE 264. "Three quarters of an hour after the delivery of the child a profuse hemorrhage came on owing to a partial separation of the placenta. From the necessity of the case the hand was immediately passed into the uterus which excited its contractions and forced the placenta into the vagina, which with a large quantity of coagulated blood was expelled by the next pain and the hemorrhage immediately ceased." Discharged after seventeen days.

15. CASE 266. "The placenta not coming away it was deemed expedient to pass the hand into the uterus which was found to have the hour glass contraction. By gentle efforts the resistance was soon overcome and the placenta expelled. On the third day this patient was attacked with severe chill followed by fever and violent pain in the region of the uterus. The antiphlogistic treatment was actively pursued and in a few days she began to recover and continued gradually getting better until the 18th day after delivery when she was seized with uterine hemorrhage. After a short

time it was arrested but returned at the same time on six successive days, but in diminished quantities owing to her remaining in the horizontal posture and diligently using tonic and astringent remedies. Her recovery remained doubtful as her legs and abdomen began to swell. She was put on the use of the muriated Tincture of Iron which not only proved tonic but diuretic and she was in a short time discharged cured."

16. Case 285. May 20, 1818 (Dr. J. M. Campbell). "From the cord being around the neck and the child's head confined so long a time (33 hr. labor) in the pelvis it was apparently dead, but by inflating the lungs and using frictions it was soon restored to life. The mother was much exhausted by the labour. The external parts contracted very shortly after delivery and to a considerable degree; the uterus remained on one side of the abdomen and without any disposition to contract. From the circumstances it was thought most advisable to leave the placenta which came away in twenty-seven hours after the birth of the child." Discharged on the nineteenth day.

17. Case 319. "This woman was taken with labour pains attended with a slight flooding previously to coming into the house. Her pains were lingering for about 24 hours when they became more severe. The child was delivered without any difficulty but the mother lost a good deal of blood—no after pains following delivery & there was a slight discharge of blood and the placenta remained in the uterus. Cold was applied to the pubis but produced no abatement of the discharge and no pains. The discharge which was very small continued for 12 hours, but did not apparently affect the woman's constitution. As the uterus showed no disposition to contract, even when the hand was introduced into it, it was thought improper to remove the placenta. It was resolved now to try ergot. 1 drachm was infused in ½ pint water & one tablespoonful given. This in about 10 minutes was repeated & in 5 minutes more the placenta was expelled & the hemorrhage arrested." Discharged after fifty-four days; no notes on post partum course.

18. Case 328. "Placenta remained 5 hours." Discharged on fourty-first day.

19. Case 334. "The placenta was retained 14 hr." Discharged on twelfth day.

20. Case 358. "Placenta removed after 14 hr. for flooding. Mother died of puerperal fever after 6 days."

21. Case 429. "Placenta in this case was taken away after being retained 11 hours." Discharged on twenty-seventh day.

PUERPERAL FEVER

In the 469 cases delivered there were 14 cases of fever (possibly 16) with 6 (probably 8) deaths. The cases were scattered throughout the series. There were only two instances in which the interval between two deaths was short. Probably not all the cases mentioned as fever were truly septic. There were not as many cases as one would have expected for no doubt they were exposed to infection all the time in the hospital. There were surgical and medical wards in contact with the lying-in ward. However, many cases of temperature may have escaped unnoticed as there were no thermometers in those days. The notes on several cases are interesting.

Case 293. "The labor was natural & the child & placenta delivered without difficulty. On 2nd day after was bled & on 3rd was seized with puerperal fever preceded by a violent chill. Was relieved by purgatives and sudorifics. On the fifth day had another chill—was relieved by purging & a large blister. Had another slight chill, since which has continued well." Discharged after twenty days.

Case 294. "Mary Ritter after a happy delivery & all circumstances favorable was seized with puerperal fever for which she was bled & purged freely. These gave relief. A few days after was seized with another fever—relieved by a large blister and purging freely." Discharged on twenty-second day.

Case 450. "In this case the waters had come away on the evening of the 8th. The physician who was called in had attempted turning but in vain. She was therefore sent to the hospital on the 9th about noon. The hand at that time projected from the external orifice. Turning was then determined on—preparatory to which she was ordered an injection and a large anodyne was administered. On returning the hand previous to turning there appeared symptoms of a spontaneous evolution & she was left to nature. About 4 o'clock P.M. the child was born. The breech coming down till the feet could escape & then becoming a footling case. The child had been dead apparently about a fortnight.

The mother had rather a tedious getting up having some degree of fever with violent deep seated pain for about a week in the left hip joint. But from this she was relieved by blisters and the antiphlogistic treatment. During the whole of the time taken up in the evolution there was not the least retraction of the protruding arm." Discharged cured. The length of stay in the hospital was not stated.

CASES 506 and 507. "Died of puerperal fever accompanied with violent typhoid symptoms which resisted every medication that could be suggested."

These are the only consecutive cases in the series.

ABSCESS OF BREAST

There were three cases (4 cases in recent series). The method of treatment was not stated. There is an instructive note on *Inverted Nipples*.

"The child was unable to suck from the nipples being wanting. They appeared to be inverted. By the women sucking the breast one breast was brought into a state that the child could suck. Cups were applied to form a nipple in the other, but in vain."

SYPHILIS

This disease was noted in two cases.

CASE 218. "This patient was received into No. 5 on the 3rd of Oct., 1816, and put on the use of the muriate of gold for syphilis. When delivered the disease was not yet cured and in consequence the child died two days after birth. After delivery the gold was resumed and she was discharged cured."

LACERATION

No mention of laceration is made and the word perineum was not used. In only one case was there any suggestion of repair.

CASE 99. "Returned to the house as a surgical patient in consequence of an extensive injury to the vagina occasioned by an ignorant midwife." The patient had been discharged undelivered by request.

In only one case (431) was the baby's weight given. The child's weight was noted as $14\frac{1}{2}$ lbs. It lived.

VACCINATION

It is interesting to note that vaccination was made a routine measure in 1810.

REMARKS

This old record gives evidence of the great progress which has been made in obstetrics and makes us appreciate our equipment. Most of the aids now considered essential were unknown then. Pelvimetry, prenatal care, social service, hospitalization, laboratory facilities, trained nursing, aseptic technique, modern methods of diagnosis including roentgenography, analgesia and anesthesia, the modern delivery room, varied operative procedures adapted to the individual case in interest of both mother and baby, improved emergency measures, immediate repair of lacerations, better knowledge of pathology, improved methods of observation and treatment, and finally the aid of the internist and pediatrician are all important factors and advances in modern obstetrical practice. These advantages have made childbirth comparatively painless and, in this series of cases, ten times as safe for the mother and at least three and one half times safer for the child at term. We realize that obstetrics has become a speciality with difficult medical and surgical phases.

BOOK REVIEWS

The first book we select from the stack at our elbow is a work the average physician would pass by, thinking it contained little to interest him. Unfortunately any volume with the word "Lectures" as part of the title is handicapped at the start. But the honest publisher must cleave close to the line and state facts and not resort to petty tricks to entice the unwary. Perhaps this is the broad cleavage line between scientific books and works of fiction. But within the covers of this volume before us is sufficient meat and facts and interesting matter to appeal to any taste.

THE NEW YORK ACADEMY OF MEDICINE LECTURES[1] is a book we recommend without

[1] LECTURES ON MEDICINE AND SURGERY, New York Academy of Medicine, First Series, 1927. N. Y., Paul B. Hoeber, Inc., 1928.

reservations to any doctor of medicine. It is a good sized book, beautifully printed and illustrated, 319 pages in length. There are 39 illustrations. On the title page we read that the lectures are on Medicine and Surgery (First Series, 1927). These lectures were given at the Academy on Friday afternoons.

We can do no better than to copy the contents:

The Treatment of Cardiovascular Syphilis, by Harlow Brooks; Intestinal Obstruction, by John F. Erdmann; Surgical Aspects of Medical Conditions, by John E. Jennings; Clinical Aspects of Common Otological Infections, by Samuel J. Kopetsky; General Infections by Bacteria, by Emanuel Libman; The Cutaneous Manifestations of Syphilis, by George M. MacKee; Climate in Tuberculosis, by James Alexander Miller; Useful Drugs in Clinical Practice, by Lewis K. Neff; Obstetrical Problems in General Practice, by John Osborn Polak; Surgical Aspects of Diseases of the Thyroid, by Eugene H. Pool; The Treatment of Pneumonia, by David Reisman; Pathological Causes of Human Misconduct, by Max G. Schlapp; Remarks on Eye Conditions, by John M. Wheeler; Problems of the Child's First Year, by Herbert B. Wilcox; Contagious Diseases, by Shirley W. Wynne. There is a complete index.

The various volumes of INTERNATIONAL CLINICS[1] are widely known and deservedly so. The present volume (First volume, thirty-eighth Series) is 307 pages in length and has 3 colored plates and about 90 illustrations, charts, etc. There are nine articles under the heading Diagnosis and Treatment, three under Medicine, two under Pediatrics, five under Surgery, three under Traumatic Surgery, two

[1] INTERNATIONAL CLINICS. Thirty-Eighth Series, 1928, Vol. I. Edited by H. W. Cattell, Phila., J. B. Lippincott Co., 1928.

under Otolaryngology, one article on Ophthalmology, two under Pathology, the 1927 Mütter Lecture of the College of Physicians of Philadelphia and an article on The Renaissance. The volume ends with an article on Progress of Medicine during 1927.

BOOKS RECEIVED

THE BRAIN FROM APE TO MAN: A Contribution to the Study of Human Evolution. By Frederick Tilney, M.D., PH.D. Two volumes, large 8vo, Cloth. Pp. 1160, 557 Illus. N.Y., Paul B. Hoeber, Inc., 1928.

THE PRINCIPLES AND PRACTICE OF OBSTETRICS. By Joseph R. DeLee. 8vo, Cloth. Pp. 1140, 1128 Illus. Phia., W. B. Saunders, 1928.

THE MIND OF THE GROWING CHILD. Edited by Viscountess Erleigh. 12mo, Cloth. Pp. 241. N. Y., Oxford Univ. Press, 1928.

GONOCOCCAL URETHRITIS IN THE MALE. By P. S. Pelouze. 8vo. Cloth. Pp. 357. Illus. Phila., W. B. Saunders Co., 1928.

RENÉ THÉOPHILE HYACINTHE LAËNNEC. By Gerald B. Webb. 12mo. Cloth. Pp. 167. 14 Illus. N. Y., Paul B. Hoeber, Inc., 1928.

DIE CHIRURGIE DER MUSKELN, SEHNEN UND FASCIEN. Von W. Muller. Lieferung 21, Die Chirurgie. 8vo. Paper. Berlin, Urban & Schwarzenberg, 1928.

DIE TECHNIK DES ORTHOPÄDISCHEN EINGRIFFS: Eine Operationslehre aus dem Gesamtgebiet der Orthopädie. Von Dr. Philipp J. Erlacher. 8vo. Paper. Pp. 492. 331 Abbild. Wien, J. Springer, 1928.

THE INTERNATIONAL MEDICAN ANNUAL: A Year Book of Treatment and Practitioner's Index. 8vo. Cloth. Pp. 590. 86 Illus. N. Y., Wm. Wood & Co., 1928.

DIAGNOSTIK MIT FREIEM AUGE: EKTOSCOPIE. Von Dr. Eduard Weisz. Dritte, erweiterte Auflage. 8vo. Paper. Pp. 196. 56 Abbild. Berlin, Urban & Schwarzenberg, 1928.

L'ANESTHÉSIE EPIDURALE. Par Germain Laporte. Preface de Victor Pauchet. 8vo. Paper. Pp. 54. Avec 17 figures dans le texte. Paris, G. Doin et Cie, 1928.

FOLKLORE OF THE TEETH. By Leo Kanner, M.D. 8vo. Cloth. Pp. 330. 17 Illus. N. Y., Macmillan, 1928.

The Surgical Clinics of North America. April, 1928. Phila., W. B. Saunders Co.

SUBJECT INDEX TO VOLUME IV

(E) = Editorial. (B.R.) = Book Review

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